THE CLASSIFICATION, DISTRIBUTION, ANALYSIS AND SOURCES OF MATERIALS IN FLAKED STONE IMPLEMENTS OF TASMANIAN ABORIGINES

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ABSTRACT

The stone materials used by Tasmanian Aborigines in their flaked stone implements are classified and their surface distribution is plotted from counts on about 15,000 implements from over 160 surface sites.

The main materials used included hornfelsic rocks, quartzites, quartz, chalcedony, opal, impure cherts, cherts, spongolite, and silicified breccias, with occasional use of basalt, dolerite and other miscellaneous rocks. The materials are grouped into a number of different associations.

The distribution of these materials in various areas of the State are analysed in detail in relation to local geology, and 180 known and probable aboriginal stone sources are listed. This study indicates the use of a wide variety of siliceous materials, commonly locally derived from outcrops or detrital deposits, but sometimes favoured materials were carried considerable distance.

INTRODUCTION

Stone implements were used extensively by the now extinct Tasmanian Aborigines. Preliminary studies of the nature, sources and relative proportions of rock types utilised in the flaked implements (Noetling, 1907, 1909a, 1909b, 1910, 1912a, 1912b) were confined mainly to central and southern Tasmania. A more comprehensive study was commenced by the present author in 1963 and a progress report was given at the 38th A.N.Z.A.A.S. Congress in Hobart (Sutherland, 1965). More recently, Jones (1965, 1966) gave some quantitative data on stone types in aboriginal sites in north-west Tasmania, and Jones (1966), Hiatt (1968) and Lourandos (1968) showed some known aboriginal quarry sites in Tasmania.

In this study, about 15,000 flaked implements from numerous aboriginal sites in Tasmania (see Appendix 1, and also Figure 6, Jones, 1968) were examined to determine the variety of materials used and their approximate quantitative distributions. The material is contained in various collections in the Queen Victoria Museum, Launceston; Tasmanian Museum, Hobart; Australian Museum, Sydney;

and a few private collections. Sorted, localised collections in the Queen Victoria Museum, with approximate numbers of specimens, include the Legge (5,100), Salter (1,200), Bremer (1,200), Jones (700), Whittle (550), Ellis (400), Heywood (200), Wilkinson (150), Hume (150) and Burns (100) collections, as well as some smaller ones. Similar Tasmanian Museum collections include the Parker (2,000) and Fenton (300) collections, and Australian Museum collections comprise about 1,100 specimens. Private collections of J. M. Curtis, Launceston, contained 350 specimens and of R. M. Jacklyn, Hobart, 740 specimens. All these collections are of surface material. There is risk that distributions of stone types plotted from such material may be unrealistic but it is considered that the overall picture is largely representative and forms a framework for more detailed and controlled collecting in excavations.

The Tasmanian aborigines greatly favoured siliceous materials in their stone industry, as in many stone idustries elsewhere, on account of the general hardness of such materials and their tendency to chonchoidal fracture, assisting flaking. In the literature, the nomenclature of siliceous rocks, especially the fine grained ones, is not well defined and organised and is confusing; many names are synonomous, overlapping or part terms (see Pettijohn, 1949, pp. 320 - 330). For this reason the nomenclature used here is first discussed and a classification suitable for use by archaeologists is proposed. Although designed to accomodate materials used by Tasmanian aborigines, sufficient framework is given so that such a classification can be expanded or modified to apply to other regions.

Aboriginal stone workers were observed in action at the Plenty native quarry (Roth, 1899), and examples of stone chipping tools are described by Legge (1930). Techniques of implement flaking and working that were probably used are discussed, amongst others, by Noetling (1907, 1909a, 1909b, 1911). Evidence of antiquity of some stone implements (David, 1924) includes a flake from 10 feet depth at the Doone Mine near Gladstone and considered to be 20,000 or even 100,000 or more years old. However, this was based on interpretation of the enclosing sediments as fluvio-glacial in origin, whereas present evidence suggests that late Pleistocene glaciation did not extend east of Ben Lomond in N. E. Tasmania (Caine, 1968). Midden sites associated with implements have been dated to at least 8,700 ± 200 years B.P., and isolation of the Tasmanian aborigines probably took place between 15,000 to 11,000 years ago (Jones, 1968). Implements older than this, and similar to those of the Tasmanian Aboriginals are known on mainland Australia (Mulvaney, 1969), but the oldest age of Tasmanian stone tools is as yet unfixed. The earlier stone industries in western Tasmania tend to be more unspecialised, with rougher, locally derived material, compared with exotic and specialised material in later industries; this may reflect progressive exploitation of more suitable stone types rather than distinct cultural change (Jones, 1966, 1968; W. D. Jackson, pers. comm).

NOMENCLATURE AND CLASSIFICATION

GENERAL

Rocks are usually classified into three groups; igneous rocks, sedimentary rocks, and rocks derived from these by metamorphism and/or metasomatism, hereafter termed the metasomites. The bias towards siliceous materials in manufacture of stone implements means that a classification useful to the archaeologist must closely consider siliceous rocks. Two sub-groups, therefore, are separated, (1) mineral forms of silica, and (2) metasomites formed by silicification (Figure 1). These divisions may seem contrived to accomodate material selected by "human preference", but the mineral forms of silica are distinctive and silicification is petrologically significant as a major process involved in diagentic, metamorphic and metasomatic changes.

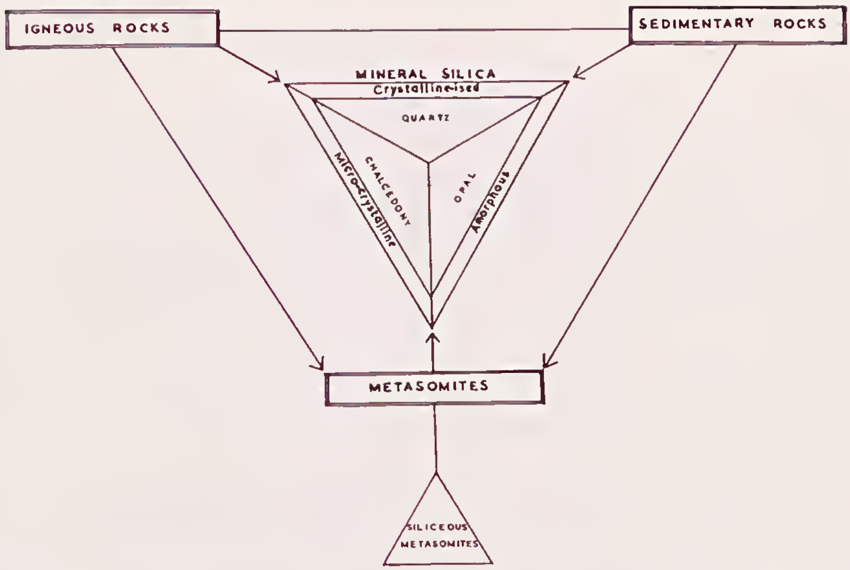

Figure 1. Classification of rocks and important siliceous sub-groups.

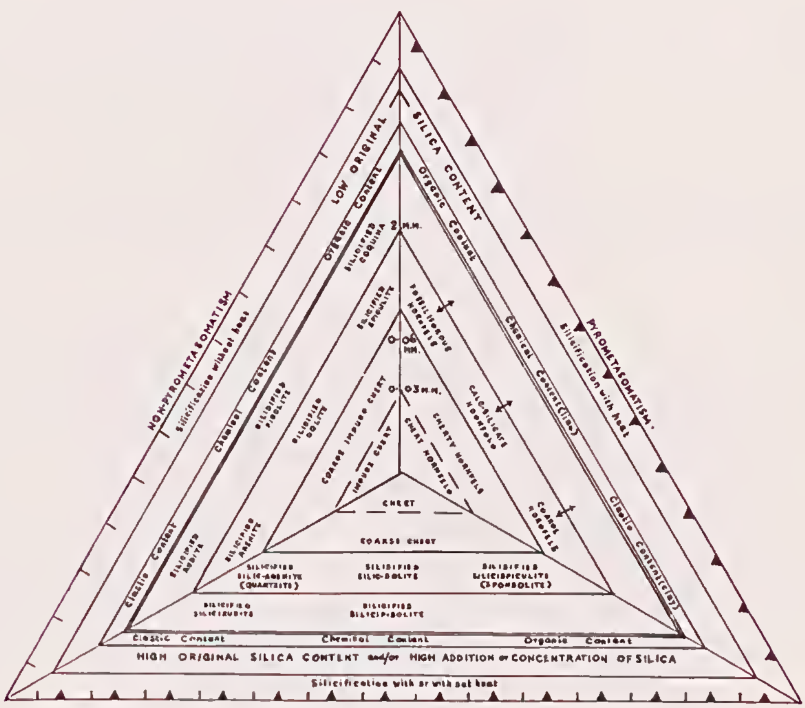

Figure 2. Classification chart of siliceous metasomatic and metamorphic rocks.

Most medium to coarse grained rocks can usually be determined through a study of their textures and mineral assemblages in the hand specimen, aided by a strong lens or binocular microscope. However, fine grained rocks present problems and may be difficult or impossible to identify even by the closest visual inspection. Determinations of specific gravity, hardness, reaction to acid, etc., enable distinction in some cases, but rocks of different origins may be similar in these respects, e. g. fine grained glassy to crystalline volcanic rocks (obsidian, pitchstone, felsite) and fine grained siliceous metasomites (buchites, cherts, hornfels). These cited examples are frequently chosen for implement manufacture. Archaeologists finding difficulty in naming such rocks, tend to use descriptive terms relating to colour or superficial texture, without always conveying the basic nature of the rock, or use a name such as chert or basalt in a very wide sense, in some cases inaccurately and misleadingly. It is recommended that archaeologists not well grounded in petrology, where possible, use the services of a petrologist to name or check identifications of their materials.

In studies where archaeologists require accurate identifications of fine grained rocks, cutting thin sections for microscope study may be necessary. This is not always practicable, and may be distasteful to the archaeologist. It can be avoided where fine grained rocks are obvious varieties of accompanying identifiable coarser grained samples, and in areas where geological surveys have accurately established the petrology of local rocks recognised in the archaeological material. This was the case with the present investigation where many of the implement materials were referable to known outcrops or rock types. In cases where local geology is unknown, or where implement materials cannot be matched with known occurrences, thin sectioning for identification may be minimised by a method of correlation. In this, such materials in a collection are separated on similar appearance into groups. A few specimens picked at random from each group are sectioned and identified, and if petrologically similar then the remainder of the samples in that group can be similarly labelled with a fair degree of confidence. Comparisons of thin sections from different groups may show that the initial grouping was based on superficial differences in colour or patina and that they are all one rock type. Where sections from a group show two or more petrological types, then close visual inspection of parent specimens may reveal small but characteristic differences enabling distinction of the remaining specimens.

The classification of rocks for archaeological use proposed here provides for the following considerations. Terminology is based, as far as possible, on easily observable or measurable propoerties, such as grain size, specific gravity, etc., with the necessity of detailed mineralogical determinations requiring thin sections kept to a minimum. Well established rock terms can be substituted where desired but controversial terms (e. g. greywacke, used both in textural or mineralogical senses) and ambiguous terms (e.g. basanite, used both for a variety of black chert and a basaltic rock) are best avoided or qualified. Finally, there is provision for naming rocks not always referable to field outcrops.

It is hoped that this present study illustrates the value and interest of detailed petrological examination of stone implements. Such studies may provide results of unexpected interest to the geologist, as well as the archaeologist, as in the following examples.

1. A survey of the stone tools in Britain provided examples of rocks in some tools, unknown in outcrop (Shotten, 1967).

2. Examination of stone adze and other implements used by natives in the central highlands of West New Guinea (West Irian) revealed glaucophanites, rocks previously unrecorded from New Guinea (Verhofstad, 1965).

3. This study revealed rock commonly used by Aborigines in Western Tasmania

as a Tertiary spongolite, previously unrecorded in Tasmania (Sutherland and Corbett, 1967).

Comprehensive studies of petrology, distribution and sources of aboriginal implement stone types in Australia, of comparable scope to this Tasmanian study, are few. There is recent work along these lines on chipped tools by Brannagan and Megaw (1969) at Curracurrang, N.S.W., and Chappell (1966) and McBryde (1966) have studied sources of ground stone tools from New Guinea and New England, N.S.W., respectively.

CLASSIFICATION OF MINERAL SILICA

The forms of mineral silica include crystalline to crystallised silica (quartz), micro-crystalline silica (chalcedony) and non-crystalline silica (opal). The latter usually can be separated by differences in hardness, lustre and specific gravity, or if necessary by their polarism under the microscope. Varieties of these materials can be further named by reference to comprehensive glossaries in texts such as those of Dana (1954) and Quick (1963). These mineral terms are best applied to implement materials only if a rock texture or knowledge of parent rock is lacking, otherwise appropriate rock names should be used e.g. quartzite rather than quartz.

CLASSIFICATION OF IGNEOUS ROCKS

Simple megascopic field classifications, suitable for many archaeological needs are given, amongst others, by Wahlstrom (1955) and Rosenfeld (1965). If greater detail is required (necessitating microscopic examination) expanded classification and identification keys, as in Wahlstrom, can be used.

CLASSIFICATION OF SEDIMENTARY ROCKS

Sedimentary rocks are a heterogeneous group and as they are commonly soft rocks are not used extensively in native stone tools. Several classifications have been proposed (see Pettijohn, 1949, Chap. 6); a simple treatment by Rosenfeld (1965) and a more detailed analysis by Wahlstrom (1955) are reasonably satisfactory for archaeological use.

A useful general classification divides sedimentary rocks according to their clastic (fragmentary, detrital), non-clastic (chemical) and biological (organic) contents, combined with their constituent size into coarse (2 mm.), medium (2-0.6 mm.) and fine (<0.06 mm.) grained divisions, with organic deposits being named according to the organism present. This classification is flexible; rocks with more than one component or constituent size can be given compound terms, e.g. arenaceous lutite, arenaceous oolite, etc., and compositions can be indicated e.g. silic-arenite, calc-arenite, etc. Well established terms can be substituted if desired e.g. quartz sandstone for silic-arenite, but controversial terms should be avoided e.g. greywackes should be described as lithic arenites, lithic lutites, etc. Other well known names include conglomerate and breccia (rudites), arkose and feldspathic sandstone (arenites). In the fine grained divisions differentiation into clastic, chemical and organic components may be impossible without detailed examination, and rocks are then best described under compositional terms e.g. mudstone, calcareous mudstone, limestone, etc. A calcareous cement in sediments is generally easily detected by effervescence with hydrochloric acid, cold or warm.

CLASSIFICATION OF METASOMITES

These represent igneous and sedimentary rocks altered by diagenetic, metamorphic and metasomatic changes. Where these effects are slight resulting in hardening of soft rocks, they can be designated as indurated. More intense changes will recrystallise and develop characteristic minerals and textures in the rocks. Completely satisfactory classifications of the metasomites are difficult because of wide variations in mineralogical and chemical compositions, fabric, and genesis of both original and final products. Classifications based on fabric and mineral compositions in field exposures, hand specimens, or thin sections (e.g. Wahlstrom, 1955) are probably most suitable for archaeologists.

The siliceous metasomites, considered here in detail due to their importance as artifact materials, will show many of the properties of mineral silica, assisting in their recognition. When rocks are silicified the end product depends on (a) the original silica content, (b) the amount of silica added, and (c) the amount of heat involved as silica may be released in chemical reactions. The important rocks in the sub-group are silicified sedimentary rocks, as igneous rocks are far less subject to change from the effects of heat and silicification and can be disregarded for most purposes. The proposed classification of siliceous sedimentary metasomites is based on their clastic, non-clastic and biological constituents and grain size, as outlined under sedimentary rocks, combined with the above-mentioned factors involved in silicification. A chart, illustrating this scheme (Figure 2) operates as follows.

The siliceous metasomite is first related to one of the three main sectors. If the mineral assemblage, hardness, texture, specific gravity, type of patina, field relationship, etc., indicate significant presence of non-siliceous material then it is placed at the top apex. If any lines of evidence also indicate that heat was involved in producing the rock then it is placed in the right hand sector (hornfelsic suite). If there is no definite evidence of heating origin, or if silicification without heat is suggested, then the rock is placed in the left hand sector (impure chert suite). Rocks with very high siliceous contents are placed in the bottom sector (chert suite) and may or may not involve heating origin. The rock can then be classified according to the constituent grain size and the type of material present.

In the finer grained rocks (grain size <0.06 mm.) distinction of clastic, chemical and organic components is usually impossible without recourse to microscopic thin section. Here non-genetic terms are used, although more specific genetic terms are available if required e.g. radiolarian chert. The term chert is widely used for fine-grained siliceous rocks, but with considerable latitudes in definition and usage. The question as to whether some cherts are primary sedimentary rocks or metasomatised sediments need not concern this thesis, as even the youngest cherts show recrystallisation analogous to devitrofication of glass (Pettijohn, 1949) and can be regarded as metasomites. In the proposed classification broad use of the term chert is avoided by providing divisions based on the three silicification factors already outlined. Thus, here chert is restricted to highly siliceous rocks and the terms impure chert and chert hornfels are introduced for the less siliceous, metasomatised and pyro-metasomatised rocks respectively.

Strictly, the term chert implies a siliceous rock whose grain is invisible to the unaided eye and should be applied to rocks with grain size less than about 0.03 mm. This is done in the classification, and to cover the small fields of rocks with grain sizes between 0.06 and 0.03 mm. the corresponding terms coarse chert, coarse impure chert, and cherty hornfels are used. Novaculites, which are siliceous rocks of porcellanaceous and gritty appearance, similar to chert but not a variety of it (Maxwell, 1963), could be accomodated amongst the coarse cherts. Imprecise terms that are often used, will cover a number of these more specific terms. Thus, porcellanite (Pettijohn, 1949) could cover coarse chert, coarse impure chert, chert hornfels, cherty hornfels, silicispiculites, and even quartzitic hornfels or quartzite, while hornstone could cover some cherts, impure chert and chert hornfels. Flint, a replacement chert, has distinctive chemical and microscopic characteristics and mode of occurrence, as in Europe, and the term should not be used indiscriminately as a synonym for chert, particularly in Australian classifications.

Once the rock is named in this scheme it can be further described, if desired, by qualifying colour and/or descriptive terms e.g. banded, schistose, massive, streaky, patinated, etc. Rocks in the impure chert and chert hornfels suites can be further subdivided on impurities present e.g. argillaceous chert (phthanite), dolomitic chert, calcareous chert, tuffaceous chert, furruginous chert (jasper), etc.

This classification, although based on genetic considerations, also provides for naming siliceous rocks if their genesis is not fully known. The archaeologist may consider it impracticable and difficult to apply without considerable thin sectioning and detailed mineralogical determination. There will of course be border line cases, as in most classifications, but it is considered good results can be obtained with judicious application of the terminology. The classification can be used to suit each individual problem and either broad or more precise terms can be selected e.g. chert hornfels as compared with brown fossiliferous arenaceous chert hornfels.

FLAKED STONE MATERIALS

MATERIAL TYPES

The following materials were identified in the flaked stone implement collections. The Aboriginal designations for some of these materials are discussed by Noetling (1909c) and Ritz (1909).

<u>Chert hornfels, cherty hornfels, and hornfels</u>, including arenaceous, silicarenaceous, rudaceous, silicirudaceous, quartzitic, fossiliferous and calcsilicate types, that may be massive, banded, streaky, spotty, or patinated in nature. These include the chert or hornstone of Noetling (1910).

<u>Quartzites</u>, including silicirudaceous types, that may be massive, banded, schistose or micaceous in nature. These include the 'porcellanite' of Noetling (1910).

<u>Spongolite</u>, as a silicified silicispiculite, that may be massive, mottled or patinated.

<u>Impure cherts and coarse impure cherts</u>, both massive and banded types and including a common distinctive dark dolomitic phthanite.

<u>Cherts and coarse cherts</u>, including massive and banded types, and rare examples of true flint.

<u>Quartz</u>, commonly veinstone quartz.

<u>Chalcedony</u>, including agate, chalcedonic wood, jasper, carnelian, etc., sometimes inseparably associated with opal and/or quartz.

<u>Opal</u>, including opalised wood.

<u>Silicified rudites</u>, commonly as breccias with lesser conglomerates, and including a distinctive brecciated banded chert.

<u>Basalt, dolerite and metadolerite</u>.

Rarely, <u>Slates, phyllites and schists</u>.

Silicarenites and silicirudites, mainly quartzitic sandstones and conglomerates.

Silicoolites and silicified calcarenites and calcilutites.

Granites, including pegmatitic and aplitic types, and minor felsitic equivalents.

These group into nine main suites, whose distribution is plotted on the Tasmanian Map (Figure 3), i.e. hornfels, quartzite, spongolite, impure chert, chert, quartz, chalcedony-opal, silicified breccia and basalt-dolerite suites. A detailed breakdown of some of the hornfels suite is also given in Figure 3.

The wide range of rocks used by the Aborigines in chipped implements reflects the varied geology of Tasmania (Spry and Banks, 1962). Ground stone artefacts of non-Tasmanoid facies from Tasmania (Scott, 1942) are of uncertain origin. Glass, china and porcelain were sporadically used following European contact (e.g. Tindale, 1942; Bryden, 1960; Plomley, 1966; B. H. Brimfield, pers. comm.; author's pers. obs.). An aboriginal midden, just N.W. of Scotts Hill, N. of Ansons Bay, contained worked pieces and fashioned implements of china, porcelain, stoneware, thick "ship's" glass, thin instrument glass and bottle glass. These were associated with a "ship's spike", copper nail and a 1816 George III shilling (suggesting a maximum date for the implement manufacture); the material does not appear to derive from any known European settlement in the area and may have been collected by the aborigines from an unrecorded ship wreck (P. Giles, pers. comm.).

VALIDITY OF THE PLOTTED DISTRIBUTION

The proportions of material types in implement collections at any site may or may not be truly representative. Discrepancies may be due to insufficient collecting, collecting over too wide an area, or biased collecting. In this study at least 20 samples were required from a site before plotting, and with greater numbers an accurate distribution pattern is more likely. Thus the number of samples is noted with the collectors' name at each site locality in the key (Appendix I) accompanying the distribution map (Figure 3).

Collections of different collectors at the same site are compared as a check for accuracy of distribution and for any bias by an individual collector (Table 1). Comparisons of collections from western Tasmania show a rough agreement in many cases, which, considering the factors which could cause variation, suggests that the plotted distribution is reasonably good. The collections from eastern Tasmania show a high degree of correspondence at many sites, and the plotted distribution is probably generally representative. It is considered that the majority of distribution percentages shown (Figure 3) are accurate to about 5-10%.

GEOLOGICAL SIGNIFICANCE OF THE MATERIALS

1. Hornfels suite. This is a product of contact metamorphism and metasomatism by Devonian-Carboniferous granite bodies intruding the pre-Carboniferous basement, by Jurassic dolerite dykes and sheets intruding Permo-Triassic strata, and by basaltic lavas intruding and overflowing Cainozoic sediments and terrains of Tasmania. Hornfelsic rocks associated with the granite intrusions occur mostly in the north-east and west of the State, those associated with the dolerites occur widely covering much of northern and eastern Tasmania (see Lourandos, 1968) and those associated with the basalts are relatively minor and sporadic in distribution. Descriptions of some typical types (Noetling, 1910) give ranges of specific gravity (2.500 - 2.847, av. 2.687).

2. Quartzite suite. The quartzites derive mainly from the Precambrian metamorphic basement, older Palaeozoic strata, and from contact zones associated with the Devonian-Carboniferous granites, Jurassic dolerites and Cainozoic basalts.

Their precise origin is not always apparent from the implement specimen, although the foliated Precambrian types are often easily distinguished from the massive varieties. Descriptions of Jurassic dolerite-Triassic sandstone contact types (Noetling, 1910) give ranges of specific gravity (2.308 - 2.700, av. 2.498).

3. Spongolite suite. These are silicified silicispiculites composed dominantly of cemented sponge spicules up to 0.5 mm. long. They show a range of red, brown, bluish black or unpigmented colours, often banded, and grading from opaque (especially on exposed surfaces) to translucent material. The pigmentation results from speckling with ferruginous material concentrated in the central canal of the spicules. It shows a general sequence of bluish black, red, brown, then unpigmented zones outwards to weathered surfaces and this appears to represent progressive oxidation and hydration of iron oxide, with final leaching. The weathered surface is generally a crust of spicules exposed by preferential removal of matrix, or is a siliceous mass of matrix containing tabular cavities left by preferential removal of spicules. Measurements of specific gravity gave the following results: Bluff Point (10 specimens 2.482 - 2.560, av. 2.522; Ordnance Point (12 sps.) 2.483 - 2.583, av. 2.533. This rock probably represents localised facies of Tertiary Miocene marine beds in N.W. Tasmania (Sutherland and Corbett, 1967).

4. Impure chert suite. The main rock type in this suite is a distinctive dark dolomitic phthanite, occurring extensively in many west coast collections. It is generally bluish black, with dullish lustre, weathers grey, and is commonly speckled with whitish flecks of dolomite and/or may be cut by regular to slightly irregular veins and joints of silica and dolomite, generally less than 2 mm. wide. The following measurements of specific gravity were obtained on this rock: Mawson Bay (10 sps.) 2.508 - 2.599, av. 2.551; Sundown Creek (10 sps.) 2.505 - 2.584, av. 2.544; Sandy Cape (10 sps.) 2.367 - 2.767, av. 2.533. The rock is derived from the Precambrian basement outcrops of the northern west coast.

5. Chert suite. Cherts occur amongst the Precambrian and Cambrian basement strata of Tasmania. In some cases these are difficult to distinguish in implement specimens from the chert hornfels of the State, although minor differences in textures and types of patina may assist. The true cherts may show characteristic contemporaneous micro-faulting and slump structure and lack the typical crusty patina that develops on many chert hornfels. Problems of separation are only important in the implement collections from northern Tasmania, where the two suites intermingle, and the respective proportions shown in the distribution map in this region are only approximate. The cherts are commonly banded, ranging from white, through yellow greys to greys, purple, red and black. Specific gravity measurements of cherts from Northdown (14 sps.) gave 2.590 - 2.650, av. 2.609, and thus fall within the lower range, but do not reach the higher values for chert hornfels reported by Noetling (1910).

6. Quartz suite. Quartz is found mainly in transparent to milky crystals, commonly in veinstone (specific gravity 2.653 - 2.680). Quartz veins are ubiquitously associated with the Precambrian and Palaeozoic basement strata and granite bodies of the State. Fragments of quartz, derived from these rocks, are also common in post-Devonian strata and in the young gravels and alluvial deposits.

7. Chalcedony-opal suite, Non-crystalline silica is commonly associated with intrusive bodies of Palaeozoic granites, Jurassic dolerites, Cainozoic basalts and to a minor extent Mesozoic (?) appinites. Silicified woods occur in some Cainozoic deposits and Permo-Triassic strata of the State. Noetling (1910) describes some of these materials and gives specific gravity ranges of 1.940 - 2.666.

8. Silicified rudite suite. Some of these are strictly varieties of the hornfels suite, being produced by contact metamorphism and metasomatism of pebbly sediments by the Jurassic dolerite and Cainozoic basalts of the State. Noetling (1910) describes such material from the Hobart area and gives specific gravity ranges of

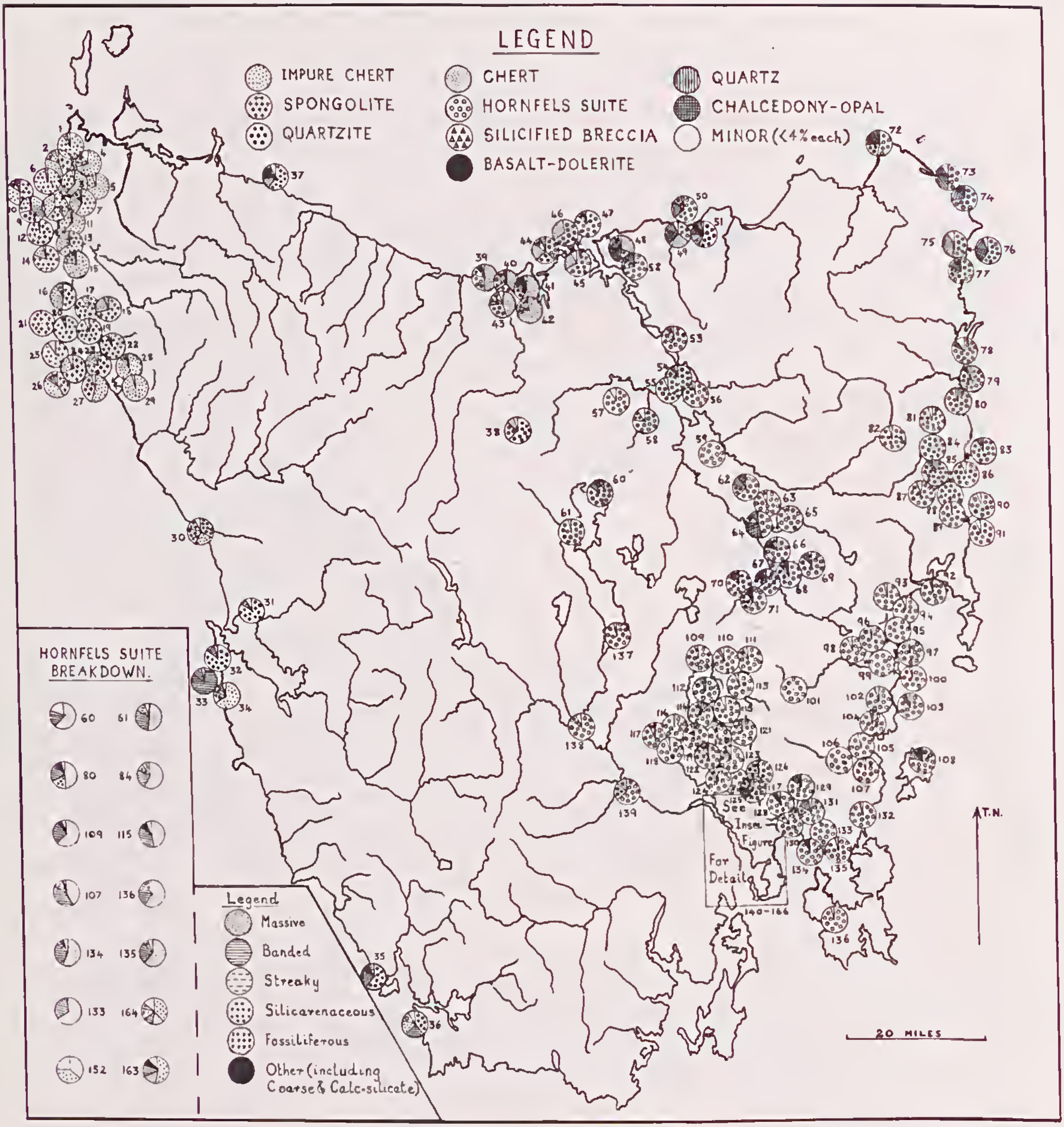

Figure 3a. Distribution map of stone types in Tasmanian Aboriginal flaked implement collections. Numbers refer to site localities, collector and number of collected specimens, as listed in Appendix I.

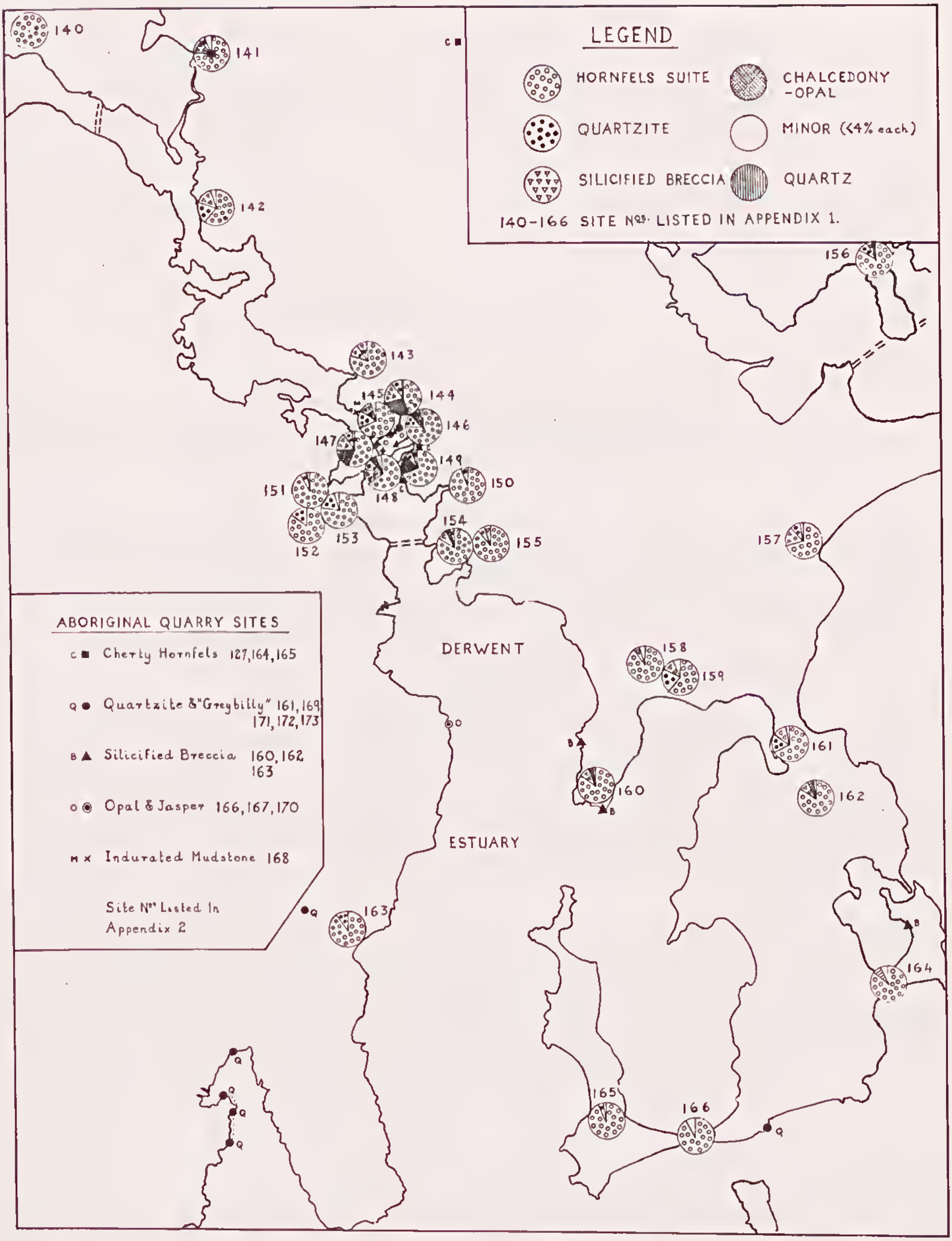

Figure 3b. Detail of distribution map of stone types in Tasmanian Aboriginal flaked implement collections, with known stone source sites, Derwent Estuary, as listed in Appendix I & 2.

2.540 - 2.782, av. 2.636. These rocks commonly grade into quartzites or silicarenaceous cherty hornfels. Distinctive chert breccias from the Precambrian-Cambrian strata also occur and many merely represent brecciated varieties of banded cherts described previously.

9. Basalt-dolerite suite. Included here are dolerites and metadolerites of Precambrian age, Jurassic dolerite and Cainozoic Basalts, but they were only worked to a minor extent.

ANALYSIS OF THE FLAKED STONE COLLECTIONS

THE BROAD DISTRIBUTION (Figure 3).

The materials of eastern Tasmania are characterised by high percentages of hornfelsic rocks, generally forming between 60 - 100% of the collections. Lesser, but noteworthy amounts, occur at a few localities in western Tasmania as around Devonport, Mole Creek and Trial Harbour.

The northern west coast collections are dominated by impure cherts (dolomitic phthanite) and spongolites (silicified silispiculite), and cherts are prominant material in the western north coast collections. Quartzites form the main element in the Rocky Cape, Mole Creek and southern west coast areas, and also appear in more limited amounts in collections on the north, north-eastern and north-western coasts, in the northern midlands and in southern Tasmania.

Mineral quartz and chalcedony-opal generally form small to moderate percentages of the collections on the northern, north-eastern and south-western coasts, and in the northern midlands and southern Tasmania; quartz may become dominant at some of the north-eastern sites. Silicified wood is only a significant material in a few north coast and southern Tasmanian collections.

Silicified breccias appear to some extent in the north coast collections around Devonport (commonly brecciated cherts) and in some of the southern Tasmanian collections, particularly on the south-east Derwent shore. Basaltic and doleritic rocks are rarely present as at Rocky Cape.

In general, eight broad stone associations can be distinguished over the State, namely the hornfels, hornfels-quartzite-silicified breccia, hornfels-quartzite-silica, quartz-hornfels-quartzite, hornfels-chert, chert-hornfels-silicified breccia, quartzite-quartz, and spongolite-impure chert associations. Areas of these associations, plotted with the outer limits of rain forest in Tasmania (mostly unoccupied by the aborigines), are shown in Figure 4. Some places, such as Rocky Cape, Trial Harbour, do not fall readily into any of these associations, but represent intermediate and sometimes complex specialised associations.

The Northern West Coast Area (Bluff Point, Mt. Cameron West, Marrawah, Green Point, West Point, Bluff Head Point, Arthur River, Sundown Point, Temma, Ordnance Point, Sandy Cape).

Spongolite (silicified silicispiculite) and impure chert (dolomiticphthanite) dominate the collections, but quartzite occurs to some extent at some sites. The proportion of spongolite to phthanite varies markedly and some collections consist almost entirely of one or the other material. Highs in the spongolite content occur at Cape Grim, Bluff Head Point and Ordnance Point, and highs in phthanite occur at Mt. Cameron West, Mawson Bay, Sundown Creek and Skull Creek.

Reported sources of the spongolite correspond generally with the two broad highs in spongolite content in the collections from Bluff Point - Mt. Cameron West and Temma - Sandy Cape and reported sources of phthanite correspond with its predominance around Mt. Cameron West and south of the Arthur River to the Temma area (Figure3, Appendix 2). Other highs in the spongolite/phthanite contents may correspond with further undiscovered exposures of these materials, but the overall pattern rather suggests that some variations in distribution reflect transport by the Aborigines.

Quartzites are locally prominent in some collections from Mt. Cameron West, West Point and Temma-Sandy Cape areas, and at one small site, observed by the author in a sand blow just south of Green Creek, the flakes were entirely quartzite. Quartzite boulders were quarried by the Aborigines at Mt. Cameron West (Figure 5, Appendix 2), and interbedded Precambrian quartzites and coarse conglomerates outcropping in the Green Point - Marrawah - West Point and Ordnance Point areas (Sutherland and Corbett, 1967) also provided the quartzitic material in the local collections. Shale outcrops and basalt boulders were worked by the Aborigines at Mt. Cameron West, but were not particularly suitable implement materials (Figure5, Appendix 2). Locally, near Interview River, middens (as seen on the coast 1 mile N. of the river) contain common implements made from spotty hornfels; these presumably derive from such metamorphosed Precambrian outcrops at the granite contact nearby (E. B. Corbett, pers. comm.).

Detailed midden excavations at West Point (Jones, 1965, 1966, 1967 and pers. comm.) gave controlled preliminary quantitative data on implement materials. Two distinct stone industries were recorded separated by a thin sand bed; the upper industry (1330 ± 80 - 1760 ± 120 B.P.) had 94% artefacts of "spongy chert", 5% quartzite and 1% "basalt", and the lower industry (1850 ± 80 B.P.) had 40% artefacts of "chert", 30% quartzite and 30% "basalt". Surface collections examined by the author from this locality contain spongolite, phthanite and quartzite, equating with Jones "spongy chert", "basalt" and quartzite. Collections from the locality by earlier collectors show marked differences in proportions of these materials and this presumably reflects indiscriminate sampling from surface float from the two horizons. Similarly, in old residual undisturbed dunes of long record, just south of the Thornton River mouth, the lowest midden layer contained only crude quartzitic implements derived from local outcrop, but all midden layers above this contained spongolite and only a small fraction of unworked quartzite (W. D. Jackson, pers. comm.). Jones (1966) considered that such changes in the stone industries were probably due to greater selectivity of good raw stones with time; the covering and uncovering of some stone exposures by sand drifts may also have played a part.

Trial Harbour Area

Collections here are complex and consist of hornfelsic rocks, quartzites, spongolite dolomitic phthanite, and other miscellaneous rocks. The hornfels suite includes chert hornfels, cherty hornfels, hornfels, and calc-silicate hornfels, including dolomitised and silicified serpentinites. The quartzites are mostly relatively fine grained types, which with the hornfels were derived from rocks of the contact zone of the Heemskirk granite mass. A small percentage of banded chert and silicified chert conglomerate in the collection may come from such outcrops of Cambrian age in the Little Henty River nearby.

Most of the materials in the collection reflect the complex local geology (Blissett, 1962). However, the spongolite and phthanite are not known outcropping locally, and may have been carried in by Aborigines from sources 45 miles or more to the north. Quartz and granite have been utilised to the north at Granville Harbour (Figure 5, Appendix 2), and littoral pebbles were probably widely worked from here to Trial Harbour.

The Southern West Coast Area (Strahan, Sloop Point, Gorge Point, Birthday Bay, North and South Port Davey).

This area is only sparsely represented in the collections, but is mostly characterised by a predominance of quartzites, commonly associated with quartz. This reflects the local geology dominated by Precambrian basement rocks (Spry and Baker, 1965). Subordinate chert hornfels, cherts, chalcedony-opal, spongolite and impure cherts (including dolomitic phthanite) are present; some may represent material washed up from off-shore outcrops, or better quality material carried in by Aborigines. Quarried outcrops and beach pebbles and boulders are known from Ocean Beach to south Port Davey (Figure 5, Appendix 2).

Rocky Cape Area

Quartzites (up to over 60%) are the dominant implement rocks here, associated with subordinate banded cherts, silicified chert breccias, spongolite, dolerite, basalt and other miscellaneous materials.

Detailed excavations in the area (Jones, 1966) show that this is generally typical, although quartz and igneous rocks occur up to maximae of 25% each in some levels, and a hard mudstone appears in the lower levels. Much of the quartzite comes from the local Precambrian rocks (Gee, 1966; Figure 5, Appendix 2), but the hard red and yellow quartzite referred to by Jones may derive from Tertiary sub-basaltic silicified sandstones of this nature at Jacobs Boat Harbour.

The presence of notable doleritic and basaltic materials is an unusual feature and they come from Precambrian dolerite and meta-dolerite dykes in the area, and more rarely from nearby Tertiary basalts (Gee, 1966). The banded cherts, silicified chert breccias and spongolite in the collections appear to be exotic and Jones (1966, and pers. comm.), demonstrated that these materials appear in the upper occupation levels of the North Cave (450 ± 105 to 3430 ± 958 B.P.). The cherts and breccias may come either from Precambrian and Cambrian outcrops, some 15 miles west, and/or from similar outcrops in the Penguin - Ulverstone area. The spongolite presumably comes from its sources on the northern west coast, over 40 miles away.

Mole Creek Area

The collection here shows predominant quartzite (60%). Precambrian types make up at least 40% of the collection, and the remainder resemble contact metamorphosed Permo-Triassic rocks, or less commonly Ordovician quartzitic sandstones. Hornfelsic Permo-Triassic rocks form about 25% and Cambrian cherts about 10% of this collection.

Geologically this region consists of folded Ordovician-Silurian strata overlain by subhorizontal Permo-Triassic beds intruded by Jurassic dolerite, with some Tertiary basalt cover (Jennings, 1963). The Precambrian quartzites were presumably obtained by the Aborigines from deposits of the Mersey River carried in from the south-west, and from pebbles freed from the Permo-Triassic rocks. Most of the other materials either outcrop or are washed in locally. The Cambrian cherts may have been carried in by Aborigines from exposures to the north, but could be derived fragments freed from the younger strata of the area. The collection as a whole contains 10% implements showing preflaking waterworn surfaces.

The Western North Coast (Mersey Bluff, East Devonport, Northdown).

Collections here are distinguished by a predominance of the chert and hornfels suites, commonly associated with silicified rudites, quartzites and chalcedony-opal. Cherts generally exceed hornfels and are typical of Cambrian outcrops in north-west Tasmania. The silicified rudites are mostly banded chert breccias, or show disrupted framework textures, typical of Cambrian types.

Geologically the area consists of Permian strata with Jurassic dolerite intrusions,

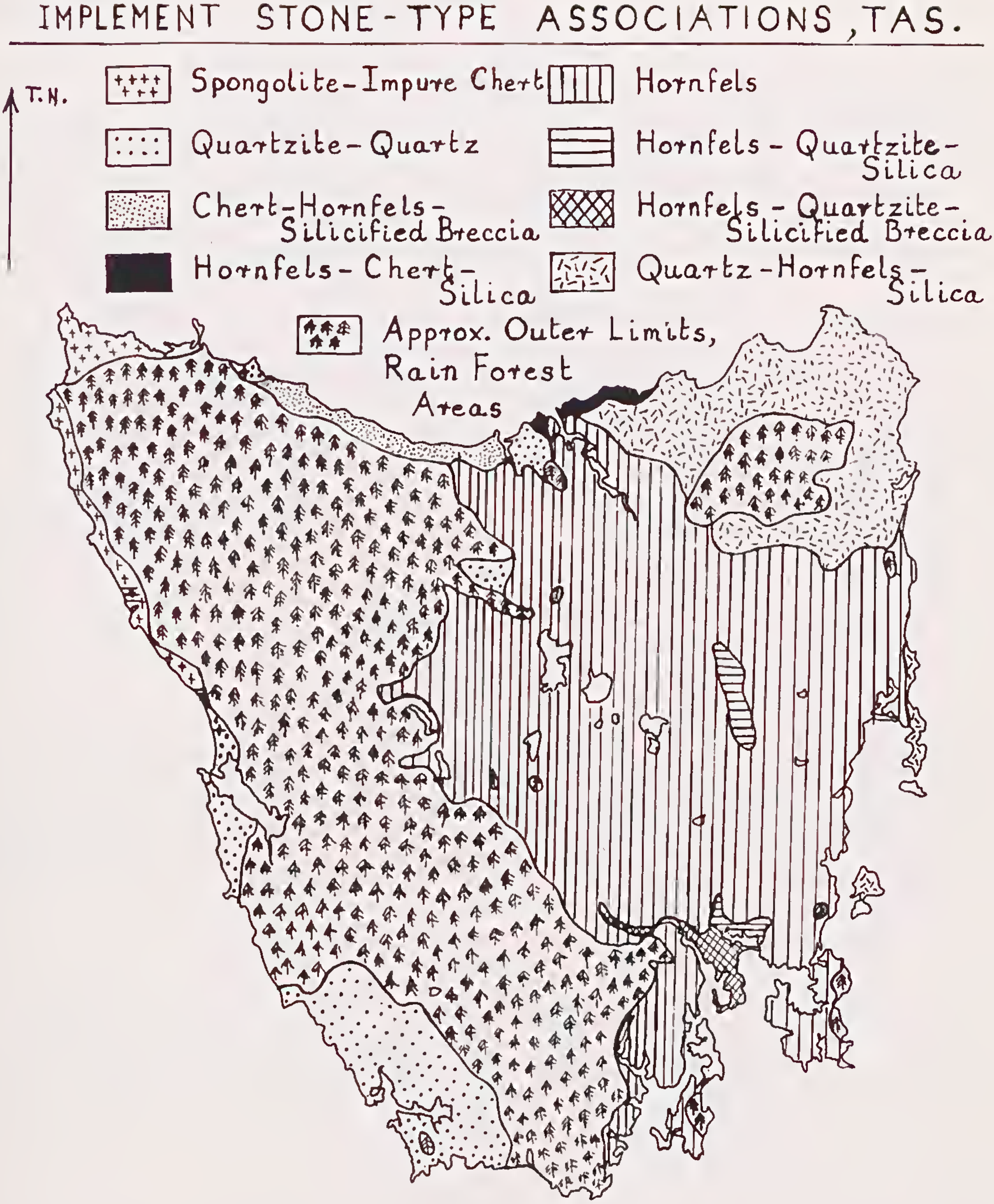

Figure 4. Broad areas of Tasmanian Aboriginal flaked implement stone type associations.

overlain by Cainozoic sediments and basalt flows, and Cambrian cherts and silicified breccias outcrop to the west and south (Burns, 1964). This matches the implement materials and some of the silicified breccia may have been quarried from the Ulverstone area (Figure 5, Appendix 2). Many of the implements show pre-flaking waterworn and percussed surfaces (33% at East Devonport, 20% at Mersey Bluff, 10 - 15% at Northdown) suggesting considerable use of transported materials washed into beach and river deposits, and a few such quarried deposits are known (Figure 5, Appendix 2). Some of the collections at Northdown contain spongolite (up to 5%) and some dolomitic phthanite typical of west coast collections, and these are probably exotic materials brought in by Aborigines.

The North Coast Area (West Beach, West Head, Five Mile Bluff, Pipers River, Pipers Rivulet).

These collections differ from those further west in hornfelsic rocks dominating over cherts, and they often contain appreciable amounts of silica and quartzite, which becomes dominant at Pipers Rivulet. The collections also generally lack silicified rudites, and where present to any extent, as at West Beach, they are generally not Cambrian types. The hornfelsic rocks include a distinctive banded chert hornfels with relics of fenestellid fossils typical of Permian strata (up to 20% at West Head and 5 Mile Bluff). The cherts are often exotic Cambrian types, and the chalcedony-opal includes silicified wood. Rare basalt appears in the collections as at Piper Rivulet.

Geologically the area consists of Lower Palaeozoic slates and quartzites overlain with Permo-Triassic strata intruded with Jurassic dolerite to the west and south, and covered in parts with Cainozoic sediments and basalt flows (Marshall, *et.al.*, 1964).

Some of the collection materials (up to 35%), particularly the cherts, show pre-flaking waterworn and percussed surfaces indicating transported materials. Much of the hornfelsic rock was presumably obtained from alluvial material washed into the area from the west into the Piper River drainage, and cherts presumably represent pebbles freed and washed down from the Permo-Triassic beds. The chalcedony-opal, and silicified wood presumably comes mostly from the Cainozoic volcanic areas, and the quartz and quartzite comes from veins in the Lower Palaeozoic strata, recycled material from the younger strata, and in the case of West Beach, material derived from Precambrian outcrops at Badger Head. Thus, much of the material was probably obtained by the Aborigines in detrital form and quarried beach deposits extend from Badger Head to west of Bridport (Figure 5, Appendix 2).

Northern and Central Tasmanian Area (Barnards Creek,Donovons Creek, Mt. Leslie, Relbia, Powranna, Cluan, Liffey, Great Lake).

Collections here generally have high hornfels contents, sometimes with minor quartzites. Most of these are chert hornfels typical of Jurassic dolerite/Permo-Triassic contact rocks, but some represent silicified Cainozoic sub-basaltic beds. In a few cases exotic cherts and chert breccias of Cambrian types are present, and are probably recycled materials from the Permo-Triassic strata. The materials generally match the geology of the area (Blake, *et.al.*, 1956; Blake, 1959; Longman, *et.al.*, 1966) and were either quarried directly from outcrops or were obtained from local detrital deposits (Figure 5, Appendix 2).

Midlands Area (Campbell Town, Ross, Mona Vale, Tunbridge).

These collections contain moderate to high contents of hornfelsic rock (50 - 90%) associated with quartzites (up to 25%), chalcedony-opal (up to 30%) and quartz (up to 10%). This correlates with the local geology of Permo-Triassic strata intruded with Jurassic dolerite and overlain with Cainozoic sediments and basalt lavas (Nye, 1921, 1926). Most of the hornfels and quartzites suites are typical of Triassic strata contacts (Figure 5, Appendix 2), but silicarenaceous cherty hornfels in the Ross - Mona Vale (12%) and Campbell Town (5%) collections probably represent Permian strata contact rocks which outcrop between Ross and Campbell Town. Vein quartz in the collections presumably derives from pebbles freed from Permo-Triassic strata, and the chalcedony-opal is a product of the Cainozoic volcanic rocks.

Northern East Coast Area (Cape Portland, Cobler Rocks, Eddystone Point, Ansons River, Ansons Bay, Bay of Fires).

This region shows collections with moderate amounts of hornfelsic rocks (50 - 65%) associated with quartz, chalcedony-opal and quartzite. Excavations in the area (Jones, 1965) suggests that surface collection distributions are inaccurate in that quartz was the dominant material used by the aborigines in much of the area, and was presumably neglected by previous collectors, due to its 'amorphous' nature.

The geology of the area is essentially folded and quartz-veined Palaeozoic quartzites and slates, intruded by granitic bodies; there are minor areas of Jurassic dolerites invading Permian strata, Mesozoic (?) appinitic rocks and Cainozoic sediments and basaltic lavas (Jennings and Sutherland, 1969). This is consistent with dominant quartz implement association. Tourmaline in rare quartz implements suggests granitic origin for some of it, and hornfelsic rocks are mostly Palaeozoic strata-granite contact types, with rare types typical of Permo-Triassic strata-dolerite contacts. Pre-flaking waterworn surfaces and exotic Cambrian rock types are much rarer in these implements than in adjacent areas to the west and south; this again reflects the general paucity of pebbly Permo-Triassic source outcrops in the area.

Pebbles of hornfels, quartzite and quartz were quarried at the Bay of Fires and St. Helens, flinty beach pebbles and quartz-chalcedonic agate from veinstones in Jurassic dolerite were worked at Cape Portland, Tertiary olivine-basalt pebbles were utilised at Cobler Rocks, and pebbles of porphyritic pitchstone of unknown provenance were used at Eddystone beach (Figure 5, Appendix 2). Rare stone core scrapers and tools are known from the Furneaux Group Islands (Tindale, 1941; Rhys Jones and R. A. Littlewood, pers. comm.). These include a crude tool of slightly sheared 'greywacke' from Whitemark, Flinders Island (possibly locally derived stone), and quartzitic ('greybilly') tools from N. W. Cape Barren Island of uncertain source.

East Coast Area (Dianas Basin, Scamander, Falmouth, Piccaninny Point, Beach End, Douglas River, Bicheno, Courland).

This composite region has typical implement materials of the northern east coast association, derived from folded Palaeozoic beds and granite intrusions, intermingled with hornfelsic rocks typical of the south-eastern coastal association derived from Permo-Triassic strata intruded by Jurassic dolerite (Walker, 1957; McNeil, 1965). This results from juxtaposition of the two geologically distinct terrains against a large fault along the east coast, downthrowing the younger rocks inland.

Many of the collections show high contents of hornfelsic rocks, and proportions of types derived from older Palaeozoic, Permian and Triassic rocks vary considerably. Triassic types are most commonly recognised and Permian types, with relic bryozoan fossils, were noted in the Piccaninny Point, Long Point, Seymour, Fingal Rivulet, Falmouth, Scamander and Dianas Basin collections, with greatest frequency at Dianas Basin (15%) and Scamander (10%). The Permian types presumably come from outcrops in the Fingal - St. Marys - Upper Scamander area, and were probably indirectly obtained by Aborigines from detritus washed down towards the coast.

Types typical of Palaeozoic granite contacts occur in the Bicheno, Beach End and Cullenswood collections and quarries are known in these rocks nearby (Figure 5, Appendix 2).

Some collections contain implements with pre-flaking waterworn and percussed surfaces (8% at Long Point, with 2% Cambrian cherts, banded chert breccias, and spilitic breccia) and these are presumably pebbles freed from Permo-Triassic strata. Granitic outcrops along the coast provide a source of quartz, which is predominant in implements along Freycinet Peninsula (Figure 5, Appendix 2); an implement of quartz in pegmatite is in the Courland collection. Hughes (1959) reports artefacts of 'chert' among middens on Schouten Island, a rock type he did not find on the Island; he infers aboriginal transport from the mainland, while Crowther (1950) records some use of the local material (Figure 5, Appendix 2).

<u>Southern East Coast and Southern Midlands Area</u> (Oyster Bay, Little Swanport, Grindstone Bay, Orford, Bream Creek, Carlton, Nubeena, Hunterston, Oatlands, Lake Dulverton, Elderslie, Hunting Ground, Melton Mowbray, Kempton, Bagdad, Pontville, Tea Tree, Brighton, Dromedary).

Very high contents of hornfelsic rocks (mostly between 85 - 100%) characterise collections of this area. The hornfels suite consists dominantly of chert hornfels and cherty hornfels, occasionally associated with minor quartzites, and they are nearly all typical of Triassic strata-dolerite contacts. A few collections contain Cambrian cherts and chert breccias, presumably from pebbles freed from Permo-Triassic strata.

In general, collections match the local geology (Hills, *et.al.*, 1922; Nye, 1921, 1922; Blake, 1958), but discrepancies occur. Chert hornfels from Permian contacts, with relic bryozoans, form 4 - 5% of the collections at Early Rises, Grindstone Bay and Ironhouse Point, but no outcrops of the rock are mapped in the vicinity. Rare implements of cherty silicified rudites, identical to the type outcropping around Droughty - South Arm area, are found in the Early Rises, Grindstone Bay, Little Swanport and Pontville collections and may have been carried in from the south by the Aborigines. The Aboriginal camps at Roaring Beach, Tasman Peninsula, contain chippings of quartz, quartzite, feldspar, jasper and other materials, besides the local chert hornfels, and were probably carried in from elsewhere; similarly on Slopen Island, amongst implements of cherty local stone, there are some of an indurated mudstone not found naturally on the island (O. W. Reid, ms. comm.). A Pontville collection includes an implement of spongolite, typical of the west coast material (Q.V.M. cat. no. 1963:44:450), which, if genuinely located, infers aboriginal transport of over 200 miles.

Numerous Aboriginal quarry sites are known in the area (Figure 5, Appendix 2). Most are in hornfelsic and quartzitic rocks at Jurassic dolerite - Triassic strata contacts with a few Permian strata contacts. Quarries are particularly abundant in the Swanston - Oatlands area, on the major Aboriginal migratory route inland along the Little Swanport River valley to the Midlands and Central Plateau. Areas of cherty hornfels up to 3/4 mile across were worked with rounded hand-size dolerite hammer stones. These hammers show impact scars, occur sporadically amongst the flaked debris, and were brought up from nearby creek beds. Quarried sub-basaltic (?) quartzite is known at Lemont, minor agate was worked near Little Swanport and Jurassic dolerite was quarried on the Swansea coast for use in large scraping and pounding tools. Very large "axes" were made from a quarry near Bothwell (133).

<u>Coal Valley and Pittwater Area</u> (Campania, Richmond, Orielton, Penna, Sorell, Four Mile Creek).

These collections resemble the hornfels-quartzite-chalcedony-opal collections of the geologically similar Midlands area, and again the appearance of chalcedony-opal

Figure 5. Known and reported Tasmanian Aboriginal stone source sites, numbers refer to site localities, description of site and sources of information, as listed in Appendix 2.

reflects the presence of widespread Cainozoic basalts (Gatehouse, 1967; Loveday, 1957). The Four Mile Creek (Iron Creek) collection contains abundant vein quartz and quartzites of Precambrian types, and these were probably obtained from detrital pebbles freed from the Permo-Triassic and younger strata. The Richmond and Penna collections contain some silicified breccias, and pass transitionally into the adjacent Southern East Derwent area collections, which typically contain such material.

Aboriginal quarry sites are known in chert hornfels (Orielton), quartzite (Campania), and in chalcedony, opal and jasper at a number of places around Sorell associated with volcanic centres (Figure 5, Appendix 2.).

Southern East Derwent Area (Bridgewater, Old Beach, Risdon, Shag Bay, Geilston Bay, Lindisfarne, Bellerive, Rokeby, Droughty Point, Single Hill, Ralphs Bay, Sandford, South Arm).

These collections generally contain 60 - 90% hornfelsic rocks, and commonly include silicified breccias (up to 15%). The silicified breccias are distinctive rocks containing angular to rounded fragments in a cherty matrix and grade to silicarenaceous cherty hornfels. Sources of such rock are known at Droughty Point and Pipe Clay Lagoon (Figure 5, Appendix 2) and the Clifton Beach collection from near this latter occurrence contains up to 40% silicarenaceous cherty hornfels of this type. Opaline material is locally important around its quarry sources as at Shag Bay, and mudstone, quartzite and sub-basaltic cherty hornfels were quarried to a minor extent from Geilston Bay to South Arm (Figures 3 & 5, Appendix 2).

This is an area of Permo-Triassic strata intruded by Jurassic dolerite, and overlain in places with Cainozoic sediments and minor basalt flows (Lewis, 1946; Green, 1961; Banks *et.al.*, 1965). Generally, the collections show some correspondence with the geology, although the implements of hornfels types typical of dolerite - Triassic strata contacts are anomalous on South Arm and suggest Aboriginal transport.

Southern West Derwent Area (Ouse, Bushy Park, New Town, Cornelian Bay, Kingston, Bruny Island).

Collections of this area show fairly high contents of hornfelsic rocks, commonly associated with quartzites (up to 25%), and many are notable for the high contents of silicarenaceous and silicirudaceous cherty hornfels (50% at Kingston, 30% at New Town). Such rocks were obtained from Permian strata near dolerite contacts (London Marsh, Oyster Cove, Chalky Point and Great Bay - Bruny Island), from sub-basaltic Cainozoic "grey billy" (Kingston, Coffee Creek, N.W.Bay), or from beach pebbles of these rocks (Margate and N. Daniels Bay); and from Triassic strata-dolerite contacts (Ellendale, Plenty River, Port Huon), as detailed in Figure 5, Appendix 2. The collections match the general geology of the area (Hills, *et.al.*, 1922; Lewis, 1946; Prider, 1948; Hale, 1953; Anand Alwar, 1960; Banks, *et. al.*, 1965).

SUMMARY

The flaked stone implements of the Tasmanian Aborigines were mostly made from siliceous materials. Use of a wide variety of such materials reflects the complex geology of Tasmania. Commonly used materials include cherty hornfelsic rocks, cherts, impure cherts, spongolite, quartzites, chalcedony, opal, silicified breccias, and rarely dolerite, basalt and other miscellaneous rocks.

Broadly, implement collections in the eastern half of the State are dominated by hornfelsic rocks. This corresponds with a geological region of abundant contact metamorphic zones of Jurassic dolerite and Palaeozoic granites, with quartz becoming

most significant in the granite areas. The collections in the western half of the State are more variable and may be dominated by cherts (with chert breccias), impure cherts (dolomitic phthanites), spongolite (silicified silicispiculites), quartzites and quartz, with rare concentrations of hornfelsic rocks. Collections over the State fall into eight main stone associations (Figures 3 and 4).

In many cases implement collections in an area show high correlation with the local geology, but in some instances much or part of the material is extraneous. There are indications of aboriginal transport of favoured materials to distances up to a few hundred miles, and to the other side of the State from the source. About 180 sources of raw materials used in the implements are now known, ranging from extensively quarried rock outcrops to worked detrital deposits (Figure 5, Appendix 2). Some island rocks were used locally, e.g. Hunter Island (Appendix 2).

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Plate 1. Site of Aboriginal quarry, 2½ miles S. of Sloop Point, north of Gorge Point. Quartz veins in the quartzite outcrop have been extensively worked on the sunny northern face (near standing figure). Quartzite hammerstones, found around the outcrop, were carried up from the boulder beach in the foreground (P. C. Sims and R. Webb party, photo).

Plate 2. Close up of north face of quarry site in Plate 1, showing host quartzite outcrop with quartz veins, with remaining quartz flakes and quartzite hammerstones (some broken) around outcrop base (P. C. Sims and R. Webb party, photo).

Plate 3(a). Aboriginal quarry, east bank, Marshalls Creek, Swanston area, showing litter of flaked cores of cherty hornfels rock.

(b). Close up of flaked cores at quarry site, showing associated dolerite hammerstones.


Plate 1

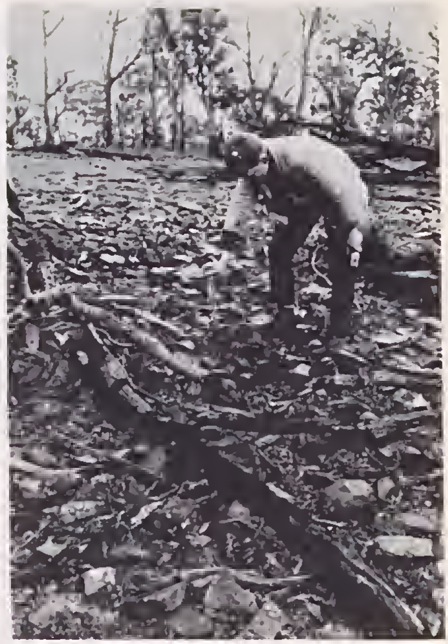
Plate (3a)


Plate 2


Plate (3b)

Plate 4(a). Extensive Aboriginal quarry, E. side of Pikes Creek, 3/4 mile from junction with Little Swanport River, Swanston area. Numerous flaked cores and flakes, with associated dolerite hammerstones, have been exposed by land clearing operations.

(b). Close up of flaked blocks of cherty hornfels rock in Aboriginal quarry on S. bank, Pepper Creek, Swanston area.

Plate 5(a). Extensively worked Aboriginal quarry in silicarenaceous cherty hornfels, exposed in low-tide reef, S. shore of Oyster Cove.

(b) Closeup of flaked surface of Oyster Cove quarry outcrop, standing between 1 to 2 feet high and littered with flakes at its base.


Plate 4(a)


Plate 4(b)


Plate 5(a)


Plate 5(b)

TABLE 1. COMPARISON OF STONE TYPE PERCENTAGES IN SITE COLLECTIONS.

Numbers in brackets refer to number of samples in collection.

S=spongolite, IC=impure chert, Qt=quartzite, Q=quartz, H=hornfels suite, C=chert, O-C=opal-chalcedony, SB=silicified breccia.

WEST COAST

Locality & Collector	Legge	Parker	Jones	Aust. Museum	Ellis
Mt. Cameron West	(60) S 61% IC 38%	(85) S 47% IC 36% Qt 9%		(23) S 72% IC 10% Qt 8%	(35) S 71% IC 23% Qt 4%
West Point	(99) S 61% IC 38%	(24) S 50% IC 34% Qt 8%	(42) IC 38% Qt 33% S 27%		
Arthur River	(32) S 80% IC 17%		(66) S 64% IC 33%		
Temma	(20) S 92% IC 8%	(70) S 71% IC 23% C 6%			
Ordnance Point	(143) S 94%		(72) S 93%		(28) S 100%
Sandy Cape	(352) S 80% IC 15%		(33) S 45% IC 40%	(26) S 91% IC 6%	(161) S 67% IC 27%

NORTH COAST

Locality & Collector	Legge	Parker	Salter	Wilkinson	Braemer & Others
Northdown			(54) C 57% H 17% SB 7% Qt 9% O-C 6% S +	(70) C 70% SB 19% H 10%	(77) C 47% H 28% SB 13% S 5% Qt + O-C +
West Head & Beach		(68) H 38% Qt 27% C 17% SB 9% Q 8% O-C +		(33) H 69% C 31%	(23) H 69% C 23% SB + O-C +
Pipers River	(49) H 33% C 28% O-C 22% Q 13% Qt +			(41) H 40% C 23% Q 22% Qt 12% O-C +	

EAST & SOUTH TASMANIA

Locality & Collector	Legge	Parker	Salter	Aust. Mus.	Braemer & Others
Winton	(80) H 47% O-C 29% Qt 12% Q 12%	(61) H 90% Qt 10%			
Mona Vale	(212) H 69% Qt 12% O-C 12%		(237) H 88% Qt 7% O-C 5%		(69) H 84% O-C 10% Qt 6%

Locality & Collector	Legge	Parker	Salter	Aust. Mus.	Braemer & Others
Tunbridge	(538) H 60% Qt 27% O-C 10% Q +	(46) H 84% O-C 8% Qt 6% Q +			
Seymour	(630) H 89% O-C 6%			(21) H 100%	
Kelvedon	(36) H 97%	(110) H 95%			
Mayfield	(90) H 100%				(22) Hey. H 100%
Orford	(115) H 97%		(33) H 100%	(67) H 96%	
Oatlands-L. Dulverton			(36) H 81% Qt 8% Q +	(21) H 95% Qt 5%	(113) H 91% Q 6% Qt +
Melton Mowbray	(211) H 91% Qt 6% O-C +		(28) H 93% O-C 7%	(49) H 92% Qt 5%	(20) H 95% Qt 5%
Pontville			(20) H 85% Qt 5% O-C 5%		(435) H 86% Qt 8% O-C 4%
Geilston Bay		(42) H 71% O-C 17% Qt 7% SB 5%			(62) Jack. H 77% Qt 10% O-C 7% SB +
Bellerive		(27) H 82% SB 11% Qt 4% O-C 4%	(26) H 87% SB 6% Qt 6%		

Locality & Collector	Legge	Parker	Salter	Aust. Mus.	Braemer & Others
Rokeby	(23) H 58% Qt 21% SB 12% O-C +	(215) H 90% SB 5% Qt + O-C +			
New Town			(306) H 89% Qt 8%	(45) H 85% Qt 15%	

APPENDIX I - LIST OF IMPLEMENT COLLECTION LOCALITIES IN DISTRIBUTION MAP OF STONE TYPES (FIGURE 3).

Initial figures refer to site numbers on map, followed by site names, letters refer to collectors identity and following numbers in brackets refer to number of implements in each individual collection at the site. Collection identities are:

L=Legge, P=Parker, S=Salter, A=Australian Museum, B=Braemer, J=Jones, W=Whittle, E=Ellis, C=Curtis, F=Fenton, H=Heywood, Wi=Wilkinson, Hu=Hume, Bu=Burns, Ha=Hay, G=Green, Ja=Jacklyn, K=Kemp, SW=Sims & Webb, W=Walter, Su=Sutherland, Y=Young.

1. Bluff Point, L(222).
2. Mt. Cameron West, P(85).
3. " " " , L(60).
4. " " " , A(23).
5. " " " , E(35).
6. Green Point, L(58).
7. Marrawah, J(320).
8. West Point, L(99).
9. " " , J(42).
10. " " , P(24).
11. Mawson Bay, L(137).
12. Bluff Head Point, L(86).
13. Arthur River, J(66).
14. " " , L(62).
15. Sundown Creek, E(71).
16. Rebecca Creek, J(35).
17. Temma, L(20).
18. " , P(70).
19. Ordnance Point, L(143)
20. " " , J(72).
21. " " , E(28).
22. Thornton River, E(20).
23. Sandy Cape, L(352).
24. " " , E(161).
25. " " , A(26).
26. " " , J(33).
27. S. Sandy Cape, E(24).
28. Italian Creek, E(28).
29. Skull Creek, E(37).
30. Trial Harbour, J(62).
31. Strahan, B(26).
32. Sloop Point, SW(45).
33. Gorge Point, SW(200).
34. Birthday Bay, SW(1100).
35. N. Port Davey, K(20).
36. S. Port Davey, K(20).
37. Rocky Cape, J(57).
38. Mole Creek, Bu(109).
39. Mersey Bluff, S(37).
40. East Devonport, B(61).
41. Northdown, S(54).
42. " , Wi(70).
43. " , B(77).
44. West Beach, P(68).
45. " " , W(23).
46. West Head, Wi(33).
47. " " , G(76).
48. Five Mile Bluff, L(361).
49. Pipers River, L(49).
50. " " , H(42).
51. Pipers Rivulet, P(37).
52. Donovans Creek, H(21).
53. Barnards Creek, W(33).
54. Mt. Leslie, W(31).
55. Beams Ford, W(26).
56. Relbia, H(95).
57. Cluan, S(24).
58. Liffey River, H(26).
59. Powranna, P(30).
60. N. Great Lake, Hu(127).
61. S. Great Lake, C(349).
62. Campbell Town, B(35).
63. Winton, P(61).
64. " , L(80).
65. Woodford, L(42).
66. Ross, L(51).
67. Mona Vale, L(212).
68. " " , S(237).
69. " " , B(69).
70. Tunbridge, P(46).
71. " , L(538).
72. Cape Portland, Su(20).
73. Cobler Rocks, W(20).
74. Eddystone, W(20).
75. Ansons River, L(50).
76. Ansons Bay, L(64).
77. Bay of Fires, L(39).
78. Dianas Basin, L(21).
79. Scamander, L(56).
80. Falmouth, A(94).
81. Cullenswood, L(39).
82. Fingal Rivulet, L(42).
83. Piccaninny Point, L(110).
84. Seymour, A(21).
85. " , L(630).
86. Long Point, L(607).
87. Douglas River, L(34).
88. Denison River, L(24).
89. Beach End, L(157).
90. Courland, L(141).

91. Bicheno, L(53).
92. Oyster Bay, L(20).
93. Kelvedon, L(36).
94. " , P(110).
95. Mayfield, L(90), H(22).
96. Lisdillon, L(106).
97. Little Swanport, L(234).
98. Little Swanport River, L(33).
99. Banwell, L(124).
100. Seaford, L(54).
101. Stonehenge, H(27).
102. Grindstone Bay, L(65).
103. Iron House Point, L(57).
104. Triabunna, L(40).
105. Orford, L(115).
106. " , S(33).
107. " , A(67).
108. Soldiers Beach, M.I.,Y(72).
109. Oatlands, A(21).
110. " , B(113).
111. Lake Dulverton, S(36).
112,. Melton Mowbray, S(28).
113. " " , B(20).
114. " " , L(211).
115. " " , A(49).
116. Hunting Ground, W(154).
117. " " , F(340).
118. Elderslie, W(50).
119. Kempton, L(37).
120. Dysart, H(28).
121. Hutton Park, L(22).
122. Bagdad, Ha(51).
123. Pontville, S(20).
124. " , B(435).
125. Tea Tree, W(28).
126. Campania, P(33).
127. Richmond, L(177).
128. Orielton, P(75).
129. Sorell, L(55).
130. " , P(39).
131. Four Mile Creek, L(23).
132. Bream Creek, P(117).
133. Carlton River, A(26).
134. Carlton, A(449).
135. Primrose Point, A(29).
136. Nubeena, A(107).
137. Hermitage, L(90).
138. Ouse, P(27).
139. Bushy Park, P(20).
140. Dromedary, W(23).
141. Glenfield, Ja(74).
142. Old Beach Road, Ja(121).
143. Risdon, S(71).
144. E. Shag Bay, Ja(173).
145. N. Shag Bay, Ja(66).
146. N. Geilston Bay, Ja(62).
147. N. Shag Bay Park, Ja(66).
148. Shag Bay Park, Ja(180).
149. Geilston Bay, P(42).
150. Lindisfarne, W(35).
151. New Town, S(306).
152. " " , A(45).
153. Cornelian Bay, B(21).
154. Bellerive, P(27).
155. " , S(26).
156. Penna, P(23).
157. Single Hill, L(23).
158. Rokeby, P(215).
159. " , L(23).
160. Droughty Point, P(54).
161. Ralphs Bay, H(28).
162. Sandford, P(70).
163. Kingston, A(31).
164. Clifton Beach, A(23).
165. South Arm, S(89).
166. S. Ralphs Bay, L(60).

APPENDIX 2 - LIST OF KNOWN TASMANIAN ABORIGINAL QUARRIES AND STONE SOURCES (FIGURE 5).

Geological stratigraphic symbols. PC=Precambrian basement, Cs=Cambrian strata, Mb=Palaeozoic Mathinna beds, DG=Devonian granite or contact, Pms=Permian strata, Trs=Triassic strata, Jdl=Jurassic dolerite contact, Tms=Tertiary marine sediments, Tbs=Tertiary sub-basaltic sediments, Tbp=Tertiary basaltic pyroclastics. Asterisk indicates sample held in Tasmanian Museum collection (M3712-3727; M4035-4078).

West Coast (N. to S.). See also Hunter Island under Additional Data below.

1. N. Mt. Cameron West. Worked outcrop (spongolite ?), now covered by large sand drift (E. E. Abblitt, pers. comm.; Sutherland and Corbett, 1967).

2. Mt. Cameron West Carvings. Flaked quartzitic fragments in multi-coloured conglomerate, 100 yds. N. of carvings site; underlying shaley outcrop and nearby beach boulders were also worked (H. Lourandos, B. H. Brimfield, pers. comm.).

3. E. Mt. Cameron West Carvings *. Quarried dark cherty outcrop (PC) surrounded with numerous loose flakes, N. bifurcation of creek, just S. of carvings and about 1 mile inland (W. Bryden, pers. comm.).

4. S. Redpa *. Minor worked blocks of silicified limestone (Tms), Salmon River track, 4 miles S. of Redpa (J. Wigg, pers. comm.; F.L.S., obs.).

5. Green Point. Worked fragments and boulders of conglomerate, quartzite and other rocks (P. Giles, pers. comm.).

6. S. Arthur River. Quarried dark cherty outcrop (PC), coast about 1 mile S. of river mouth (R. Jones, pers. comm.).

7. Sundown Point. Worked dark cherty low-tide reek (PC), 1/2 mile N. of point (W. D. Jackson, pers. comm.).

8. Nelson Bay. Worked dark cherty low-tide reef (PC), 3/4 mile S. of Nelson Bay River (W. D. Jackson, pers. comm.).

9. S. Temma. Worked spongolite boulders (Tms), inland near No Mans Creek (J. Wigg, W. D. Jackson, pers. comm.; Sutherland and Corbett, 1967).

10. Ordnance Point. Small low-tide spongolite exposure (Tms), N. of point (W. D. Jackson, pers. comm.).

11. Green Creek. Worked quartzite pebbles and flakes, beach S. of creek (F.L.S., obs.).

12. Thornton River. Worked spongolite outcrop (Tms), between 1 - 1½ miles upstream from river mouth (W. D. Jackson, pers. comm.).

13. Granville Harbour. Worked quartz and granite beach pebbles (H. Lourandos, pers. comm.).

14. Trial Harbour. Use of hornfels and other rocks from shore deposits (F.L.S., obs.).

15. Strahan. Worked, poor-grained quartzite and quartz pebbles, Ocean Beach (B. H. Brimfield, pers. comm.).

16. Sloop Point. Two superficially quarried quartzite outcrops (PC), about 1000 ft. apart, each worked on about 10 sq. ft. on an 8 ft. high face, angled about 45°, S. end of coastal midden, 8 miles S. of Cape Sorell Lighthouse; small, sharp, but little worked implements were mainly manufactured and apparently were mostly carried away to the midden area (P. C. Sims and R. Webb party, pers. comm.).

17. S. Sloop Point. Extensively worked, prominent quartzite and vein quartz outcrop (PC), 40 ft. high, 2½ miles S. of point. Vein quartz was quarried along the whole of the sunny northern face, using quartzite hammerstones (many shattered in use) brought from the adjacent pebble beach. Remaining implements are little worked flakes and include some rare foreign chert (P. C. Sims and R. Webb party, pers. comm.; Plates 1 & 2).

18. Gorge Point. A few worked quartzite, quartz, schist and chert fragments are associated with quartz, hematite and spongolite implements and fractured quartzite pebbles. Material was apparently carried in at least 1 mile from its nearest source (P. C. Sims and R. Webb party, pers. comm.).

19. Birthday Bay. Worked stones, carried at least 350 yds. from nearest source, are associated with numerous implements, and include chert, spongolite, quartzite, vein quartz, schist and slate. The implements are classified as 26% knives, 24% end scrapers, 23% points, 9% duck-billed scrapers, 7% pounders, 6% concave scrapers, 3% augers, 2% cleavers, and needle-like point ground from slate (P. C. Sims and R. Webb party, pers. comm.).

20. Port Davey. Worked outcrop of cherty quartzite, on shore of Schooner Cove (Lord, 1928).

21. S. Port Davey. Worked, hard boulders of quartzy rock, Windowpayne Bay (Plomley,1966, 228; Jones, 1966; Hiatt, 1968; D. King, pers. comm.).

North Coast (W. to E.).

22. Rocky Cape *. Quarried cave walls and prominent nearby quartzite outcrops (PC), and worked material from raised and present beaches. Metadoleritic material probably derived from dykes 100 yds. from North Cave and 400 yds, S.E. of South Cave (Jones, 1966 and pers. comm.; H. Lourandos, pers, comm.).

23. Jacobs Boat Harbour *. Probable quartzite (Tbs) source (F.L.S. obs.).

24. E. Wynyard. Worked crude quartz and quartzite pebbles on beach and rocky outcrops, 8 miles W. of Burnie (B. H. Brimfield, pers. comm.).

25. Penguin. Outcrop and pebble source of cherts and chert breccias (Cs), E. of Watcombes Beach (F.L.S., obs.).

26. Lodders Point. Worked boulders of yellowish breccia (Cs?), shoreside, W. of point (W. D. Jackson, pers. comm.).

27. W. Ulverstone. Worked greyish breccia outcrop (Cs?), in gulley above Bass Highway, 2 miles W. of Picnic Point (Noetling, 1909b; Lourandos, 1968; W. D. Jackson, pers. comm.).

28. Forth. Worked hornfels pebbles, Lillico Beach (B. H. Brimfield, pers. comm.).

29. E. Devonport. Worked hornfels and quartzite pebbles, from Pardoe Beach as far

as Northdown (B. H. Brimfield, pers. comm.).

30. Badger Head. Worked chalcedony, hornfels and quartzite beach pebbles (B. H. Brimfield, pers. comm.).

31. E. Low Head. Worked chalcedony, hornfels and quartzite beach pebbles (B. H. Brimfield, pers. comm.; F.L.S. obs.).

32. Currie. Worked chalcedony, hornfels and silicified wood beach pebbles (Brimfield, 1968 and pers. comm.).

33. Tam O'Shanter Bay. Quarried chalcedony, hornfels and quartzite and minor silicified wood beach pebbles (H. Lourandos, B. H. Brimfield, pers. comm.).

34. Tam O'Shanter Bay. Flaked outcrop (9 x 6 ft. across) of multicoloured quartz pebble conglomerate, some well grained, others poorly grained. On beach line ½ mile E. of Lulworth (B. H. Brimfield, pers. comm.).

35. Tam O'Shanter Bay. Flaked outcrops of white, poor grained quartzite at two spots ½ mile E. of Lulworth (B. H. Brimfield, pers. comm.).

36. Weymouth . Worked chalcedony, hornfels, quartzite and silicified wood beach pebbles (Brimfield, 1968 and pers. comm.).

37. W. Bridport. Worked hornfels, chalcedony and quartzite beach pebbles (B. H. Brimfield, pers. comm.).

38. Blackmans Lagoon. Worked quartzite, quartz and hornfels pebbles from beach, about 400 yds. N. of Lagoon (B. H. Brimfield, pers. comm.).

39. Cape Portland *. Chalcedonic veinstone cutting country rocks, used in local implements (Jennings and Sutherland, 1969).

40. E. Cape Portland *. Worked flinty beach pebbles, including silicified sponge (Tms?) samples (B. H. Brimfield, pers. comm.; F.L.S. obs.).

North and Central Tasmania (N. to S.).

41. Tamar River. Reported quarry source (Roth, 1899; Noetling, 1909b). This may refer to cherty hornfels (Jdl-Pms) at Dilston (Carey, 1946). Petrified wood, quartzite, quartz and hornfels pebbles were utilised from all along the river edge (B. H. Brimfield, pers. comm.) e.g. Robigana, Hillwood.

42. Frankford-Glengarry. Worked white quartzite and quartz nodules and pebbles in bush soilsand creekbeds (B. H. Brimfield, pers, comm.).

43. Windermere. Worked, variable sized chalcedony and quartzite pebbles in gravel beds, on "Native Point"; site now greatly disturbed by gravel mining (B. H. Brimfield, pers. comm.).

44. Tayene *. Worked quartzite pebbles and host siliceous conglomerate (Tbs), E. of road, 2 miles N. of Tayene (F.L.S., obs.).

45. Launceston. Worked quartzite and weathered dolerite pebbles from gravel beds, Pegatta Point, 1 mile N. of Launceston, East Tamar (David, 1924).

46. St. Leonards. Worked fragments of dense blackish cherty hornfels, E. bank, N. Esk, S. end of Hoblers Bridge (G. Jackson, pers. comm.).

47. E. Carrick . Sparse, worked, large, poor-grained quartzite pebbles, 100yds. S. of Meander River, 10 miles W. of Launceston on Bass Highway; site since destroyed for grazing (B. H. Brimfield, pers. comm.). Also at Exton.

48. Perth. Reported quarry (Roth, 1899; Noetling, 1909b); cherty hornfels outcrop (Jdl-Pms) and boulders in river (F.L.S., obs.).

49. Delmont. Broken greyish quartzite nodules, littering area about 800 ft. by 80 ft., "Little Forest", on hillside, W. bank on turn in Lake River, 500 yds. W. of Cressy-Campbell Town Road, with associated fashioned quartzite, hornfels and chert implements (B. H. Brimfield, pers. comm.).

50. Walls of Jerusalem. Worked fragments of cherty hornfels (Jdl-Trs), above western walls (K. D. and E. B. Corbett, pers. comm.).

51. W. Great Lake *. Reported quarry near Split Rock (Smyth, 1878, 404-405; Roth, 1899; Noetling, 1909b; Jones, 1966; Hiatt, 1968). Probably relates to cherty hornfels outcrop, (Jdl-Tb-Trs), N.W. side of Canal Bay (F.L.S., obs.), and in vicinity of Liaweene Canal (W. D. Jackson, pers. comm.).

52. S. W. Great Lake. Reported quarry, west of Swan Bay (Lourandos, 1968).

53. S. Great Lake *. Reported quarry (Lourandos, 1968). Probably cherty hornfels float (Tbs), associated with worked flakes, N. end of Becketts Bay, S. E. side Maclanachans Point, exposed during 1968 drought low-level (F.L.S., obs.).

54. Lagoon of Islands. Worked pavement of cherty hornfels between dunes, N. end of lunette (W. D. Jackson, pers. comm.).

55. Lake Sorell. Source outcrop of cherty hornfels (Jdl-Trs), inland of Dogs Head Point (W. D. Jackson, pers. comm.; F.L.S., obs.).

56. Bronte. Extensive cherty hornfels (Jdl-Trs?) source, London Marsh (Prider, 1948).

57. Mt. Rufus. Numerous worked fragments of whitish finegrained stone, walking track on slopes about 1 mile E. of summit (A. Hewer, pers. comm.).

East Coast (N. to S.)

58. Cobler Rocks *. Worked beach boulders and pebbles (H. Lourandos, pers. comm.), including olivine-basalt (ident. F.L.S.).

59. Eddystone Point *. Quarried beach boulders and pebbles (D. I. Groves, pers. comm.), including cherty hornfels (Mainly DG-Mb types) and a porphyritic rhyo-dacitic pitchstone (ident. F.L.S.).

60. Bay of Fires. Worked hornfels, quartz and quartzite beach pebbles (B. H. Brimfield, pers. comm.).

61. St. Helens. *Ibid*, including Dianas Basin (F.L.S., obs).

62. Piccininny Point. Quarried hornfels outcrop (DG-Mb) and worked beach pebbles (H. Lourandos, 1968 and pers. comm.).

63. Long Point. *Ibid.*

64. MacLean Bay. Worked cherty hornfels beach pebbles, near lagoon toward S. end of bay (K. D. Corbett, pers. comm.).

65. N. Bicheno. *Ibid*, opposite Diamond Island (W. D. Jackson, pers. comm.).

66. Bicheno. *Ibid*, 3/4 mile S. of Diamond Island (W. D. Jackson, pers. comm.).

67. N. Cape Lodi. Worked cherty hornfels boulders, (W. D. Jackson, pers. comm.).

68. Half Moon Bay. *Ibid.*

69. Butlers Point. Extensive quarried contact (DG-Mb) and worked hornfels beach boulders, N. side of point (W. D. Jackson, pers. comm.).

70. Bluestone Bay. Quarried quartz veins in granite and worked quartz and hornfels pebbles on beach (H. Lourandos, pers. comm.).

71. Wine Glass Bay. Quarried quartz veins and worked beach pebbles, S. end of Bay; similar workings extend along much of Freycinet Peninsula (H. Lourandos, W. D. Jackson, pers. comm.).

72. Schouten Island. Worked beach pebbles on eastern shore, (Crowther, 1950).

73. Webber Point. Dolerite outcrop (Jdl) worked for large scraping tools, on beach S. of Point (B. H. Brimfield, pers. comm.).

74. S. Swansea. Worked hornfels beach pebbles, south to Kelvedon Beach (B. H. Brimfield, pers. comm.).

75. N. Kelvedon. Cherty hornfels (Jdl-Trs) quarry site (Lourandos, 1968 and pers. comm.).

76. Kelvedon. Cherty hornfels (Jdl-Trs) quarry site (Crowther, 1950; Lourandos, 1968 and pers. comm.).

77. S. Kelvedon. Quarried cherty hornfels (Jdl-Trs) at 30 Acre Creek (W. D. Jackson, pers. comm.).

78. Mayfield. Cherty hornfels (Jdl-Trs) quarry site (Crowther, 1950; Lourandos, 1968; and pers. comm.).

79. Lisdillon *. Extensively worked cherty hornfels (Jdl-Trs) quarry area, ½ mile across, W. side Tasman Highway, ½ mile N. of Lisdillon Rivulet (W. D. Jackson, R. M. Jacklyn, pers. comm.; F.L.S. obs.).

80. W. Little Swanport. Worked fragments of carnelian and other agates, with associated agate hammerstone, N. side Stonehenge Road, 2 miles W. of Little Swanport; site destroyed by later collectors (P. Giles, pers. comm.).

81. Little Swanport. Minor worked cherty hornfels outcrop (Jdl-Trs), W. bank Ravensdale Rivulet (Lourandos, 1968; F.L.S. obs.).

82. Point Bailey. Extensive cherty hornfels quarry site (Jdl-Trs), 3 miles S.W. of Point (Lourandos, 1968; P. Giles, pers. comm.).

83. Grindstone Bay. Worked cherty hornfels boulders, W. of lagoon, inland of bay, associated with numerous dolerite pounders (W. D. Jackson, pers. comm.).

84. Okehampton Bay. Quarried cherty hornfels outcrops (Jdl-Trs) and beach pebbles, S. E. of Triabunna (Ling Roth, 1899; H. Lourandos, pers. comm.).

85. Spring Bay. *Ibid.* S. of Triabunna (H. Lourandos, pers. comm.).

86. Stapleton Point. Quarried cherty hornfels outcrops (Jdl-Trs), W. side of point and 3/4 mile west (Lourandos, 1968 and pers. comm.).

87. N. Maria Island. Worked cherty hornfels and quartz fragments in sand dunes, Soldiers Beach (W. Dunbabin, P. Young, pers. comm.).

88. Middle Peak. Reported quarry (cherty hornfels-Jdl-Trs?), S. E. slopes, 5 miles W. of Cape Bernier (Lourandos, 1968 and pers. comm.).

Midlands and Eastern Tasmania (N. to S.).

89. N. Waters Meeting. Quarried cherty hornfels contact (Jdl-Trs), N. of west Branch River, W. side of road, 7 miles N. of Cranbrook (W. D. Jackson, pers. comm.).

90. S. Waters Meeting. *Ibid*, W. side of road, 6 miles N. of Cranbrook (W. D. Jackson, pers. comm.).

91. Syndal. Quarried cherty hornfels (Jdl-Trs?) outcrop (Noetling, 1909b; Jones, 1966; Hiatt, 1968; Lourandos, 1968).

92. Lake Leake. Quarried cherty hornfels pebbles and boulders in gravel matrix, on low hill, 1½ miles S. E. of southern lake shore (Westlake, mms.; Noetling, 1909b; David, 1924; Jones, 1967 and pers. comm.).

93. S. Grimes Lagoon. Worked (?) edges on quartzite slabs, (Tb-Trs), N. side Dons Battery (F.L.S., obs.).

94. Tunbridge. Cherty hornfels pebble source, W. side York Rivulet, 1 mile N.E. of Tunbridge (F.L.S., obs.).

95. Blackmans River. Minor working of cherty hornfels and quartzite (Jdl-Trs), W. bank of river, 2½ miles N. W. of Woodbury (P. Young, pers. comm.; F.L.S., obs.).

96. W. Blackmans River. Cherty hornfels source (Jdl-Trs), Old Tiers Road, 4½ miles W. of Woodbury (F.L.S., obs.).

97. Brents Sugar Loaf. *Ibid*, S. of road, 6 miles E. of Woodbury (F.L.S., obs.).

98. Macquarie River. Worked cherty hornfels outcrop (Jdl-Trs?) S. of river, N. side Toombs Lake Road, 14 miles S. E. of Ross (W. D. Jackson, pers. comm.). A reported quarry in this area (Scott, 1873) is not precisely located or yet confirmed in relation to the above site, while Noetling (1909b) has discounted other quarry sites reported by Scott near the Macquarie River, However, Stephens (1909) comments on a cherty outcrop source at the head of Macquarie River.

99. N. York Plains*.Cherty hornfels source (Jdl-Trs), 3 miles S. E. of Antill Ponds and along railways N. of York Plains (Hiatt, 1968; Parker Colln., Tas. Mus.; F.L.S., obs.).

100. Mt. Pleasant. *Ibid*, 1 mile N. E. of Mt. Pleasant (F.L.S., obs.).

101. St. Peters Pass *. Quarried cherty hornfels (Jdl-Trs) outcrop, 3 miles N. of Oatlands (Jones, 1966; Lourandos, 1968; F.L.S., obs.).

102. Flinty Bottom *. Extensive cherty hornfels (Jdl-Trs) workings (F.L.S., obs.).

103. N. Flinty Marsh *. Minor cherty hornfels (Jdl-Trs) working, ¼ mile above N. E. end of marsh (F.L.S., obs.).

104. S. Flinty Marsh. Worked cherty hornfels (Jdl-Trs), 2¼ miles N.W. of Oatlands (F.L.S., obs.).

105. N. Oatlands. Cherty hornfels source (Tb-Trs?), 1½ miles N. W. of Oatlands (F.L.S., obs.).

106. N. Lemont. Loose worked cherty hornfels boulders, D.W.P. Burbury's property, 2 miles S. E. of Toombs Lake - Lemont Road Junction (W. D. Jackson, pers. comm.).

107. Crown Lagoon. Quarried cherty hornfels blocks in ground (Lourandos, 1968, and pers. comm.).

108. Lemont.*. Worked quartzite and rare cherty hornfels blocks (Tbs-Trs), N. side Nala Road, 1 mile W. of Lemont (F.L.S., obs.).

109. Lemon Hill. Quartzite source (Jdl-Trs), now disturbed by commercial quarry (H. Lourandos, pers. comm.; F.L.S., obs.).

110. Pepper Creek. Worked cherty hornfels boulders, W. bifurcation of E. branch, 3 miles S. W. of Little Swanport River junction (F.L.S., obs.).

111. Pepper Creek *. Quarried cherty hornfels outcrop (Jdl-Trs), S. bank, 2 miles S. W. of Little Swanport River junction (W. Dunbabin, pers. comm.; F.L.S., obs.; Plate 4b).

112. E. Marshalls Creek. *Ibid*. 2½ miles S. E. of Little Swanport River junction (P. Dunbabin, pers. comm.; F.L.S., obs.).

113. E. Marshalls Creek *. *Ibid*, 3 miles S. E. of Little Swanport River junction (P. Young, pers. comm.; F.L.S., obs.).

114. Marshalls Creek *. *Ibid*, E. bank, 1 3/4 miles S. of Little Swanport River junction (N. & P. Young, pers. comm.; F.L.S., obs., Plate 3).

115. Marshalls Creek. *Ibid*, E. and W. banks, 2 miles S. of Little Swanport River junction (W. & P. Dunbabin, pers. comm.; F.L.S., obs.).

116. W. Marshalls Creek. *Ibid*, 2¼ miles S. of Little Swanport River junction (N. & P. Young, pers. comm.; F.L.S., obs.).

117. Pikes Creek. *Ibid*, E. bank, ¼-½ mile S. of Little Swanport River junction (N. & P. Young, pers. comm.; F.L.S., obs.).

118. Pikes Creek *. *Ibid*, E. bank, 3/4 mile S. of Little Swanport River junction (N. & P. Young, pers. comm.; F.L.S., obs.; Plate 4a).

119. Little Swanport River. Minor quarried cherty hornfels outcrop (Jdl-Trs). N. bank, 3/4 mile W. of Pikes Creek junction (N. Young, pers. comm.).

120. Mt. Seymour *. Quarried cherty hornfels (Jdl-Trs), N. E. flank about 1½ miles from the summit, E. bank, Lightwood Rivulet, 3¼ miles S. E. of Andover Railway Station (M. Lester, P. Young, pers. comm.; F.L.S., obs.).

121. N. Andover *. *Ibid*, N. side Andover-Oatlands Road, 1 mile W. of Andover Railway Station (P. Young, pers. comm.; F.L.S., obs.).

122. S. Andover *. *Ibid*, about 1 mile S. of Andover (N. & P. Young, pers. comm.).

123. Lake Tiberias. Cherty hornfels source (Jdl-Trs), 1 mile S. E. of Stonor, Baden-Rhyndaston Road junction (F.L.S., obs.).

Southern Tasmania (E. to W.).

124. Bluff River. Reported cherty hornfels quarry (Jdl-Trs), 4½ miles N.W.N. of Buckland (H. Lourandos, 1968 and pers. comm.).

125. Orielton. Cherty hornfels quarry (Jdl-Trs), 1000 yds. S. W. of Orielton House (Lewis, 1946, 204).

126. Campania. Worked quartzite outcrop (Jdl-Trs) W. side of Coal River - White Kangaroo River junction (F.L.S., obs.).

127. Tea Tree. Cherty hornfels quarry (Jdl-Trs), S. of Elliots-Phillips Saddle (Lewis, 1946, 199).

128. Pontville. Quartzite quarry (Jdl-Trs), near old railway station (Noetling, 1909b; Jones, 1966).

129. N. Kempton. Quarried cherty hornfels boulder (Noetling, 1909a).

130. Hutton Park. Cherty hornfels quarry S. W. side of Estate (P. Giles, pers. comm.).

131. Coal Hill. Cherty hornfels quarry (Jdl-Trs), ½ mile N. of Melton Mowbray (Walker, 1902, 281; Noetling, 1909b; Jones, 1966).

132. Melton Mowbray. *Ibid*, 4 miles W. of Melton Mowbray (Noetling, 1909b; Jones, 1966).

133. Woods Quoin Rivulet *. Reported quarry, probably cherty hornfels and silicified breccia (Jdl-Pms), 5 miles N. E. of Bothwell (Lourandos, 1968 and pers. comm.; Tas. Mus. colln.). See also under Additional Data below.

134. S. Bothwell. Worked quartzite and cherty jasper outcrop, 4 miles S. of Bothwell on Hamilton Road (P. Giles, pers. comm.; F.L.S., obs.).

135. Clyde River. Reported quarry, probably cherty hornfels (Jdl-Trs), N. bank of river, 6½ miles W. S. W. of Bothwell (Lourandos, 1968 and pers. comm.). Quartzite and cherty hornfels also appear to have been worked on the S. bank of the river about 4 miles from Bothwell (F.L.S., obs.).

136. Plenty. Observed use of cherty hornfels outcrop (Jdl-Trs) by Aborigines, "Native Tier", about 2 miles S. W. from old Plenty Railway Station

(Roth, 1899; Noetling, 1909b; Jones, 1966; Hiatt, 1968).

137. Glenora. Reported quarry, probably cherty hornfels (Jdl-Trs), about 2 miles N. W. of Glenora (Lourandos, 1968).

138. Meadow Banks. Worked quartzite boulders, above sandstone cliffs, S. side Meadow Banks Reservoir, about 5 miles S. E. of Ouse (W. D. Jackson, pers. comm.).

139. N. Ellendale. Quarry site on "Flinty Hill", about 1 mile W. of Ellendale-Dunrobin road, about 7 miles N. of Ellendale (C. Cooke, pers. comm.), probably cherty hornfels (Jdl-Trs).

Southern Coast (E. to W.).

140. Remarkable Cave. Quarried cherty hornfels outcrop (Jdl-Trs), cliff-top above cave, Tasman Peninsula (H. Lourandos, 1968 and pers. comm.).

141. Two Beach Bay. Quarried pebbles, on beach towards Tunnel Bay, Tasman Peninsula (O. W. Reid, mms. comm.).

142. White Beach. Quarried pebbles, N. end of beach, Tasman Peninsula (O. W. Reid, mms. comm.).

143. S. Wedge Bay. Quarried cherty hornfels (Jdl-Trs), rocky shore, 2½ miles S. W. of Nubeena, Tasman Peninsula (W. D. Jackson, pers. comm.).

144. Roaring Beach. Quarried pebbles, S. end of beach, Tasman Peninsula (O. W. Reid, mms. comm.).

145. Billy Blue. Quarried cherty hornfels (Jdl-Trs), S. side of ridge, E. of Roaring Beach, Tasman Peninsula, (O. W. Reid, mms. comm.).

146. Mt. Zion. *Ibid*, about 1 mile S. of Mt. Communication, Tasman Peninsula, (J. Hull and A. R. Watts, pers. comm.).

147. Mt. Communication. *Ibid*, Tasman Peninsula (Roth, 1899; Noetling, 1909b; Jones, 1966; Hiatt, 1968; Lourandos, 1968).

148. Boat Harbour *. Worked beach boulders and pebbles of cherty hornfels and fine grained basalt, on point, 1 mile N. W. of Slopen Main Beach, Tasman Peninsula (A. R. Watts, pers. comm.; F.L.S., obs.).

149. S. Slopen Main. Worked cherty hornfels outcrop (Jdl-Trs), shore, 1¼ miles from old jetty towards North West Head, Tasman Peninsula (W. D. Jackson, pers. comm.).

150. Storm Cove. *Ibid*, Tasman Peninsula (J. Hull and A. R. Watts, pers. comm.).

151. Slopen Island. Quarried cherty beach boulders, probably washed up from off-shore outcrops (O. W. Reid, mms. comm.).

152. Carlton River. Minor worked cherty hornfels pebbles, E. foreshore, 200 yds. upstream of Carlton-Dunalley road bridge (F.S.L., obs.).

153. Carlton Estuary *. Worked cherty hornfels pebbles, E. foreshore, 2 miles N. E. of Carlton Bluff trig. point (M. Murrell, pers. comm.; F.L.S., obs.).

154. E. Iron Creek *. Minor worked agate pebbles with waste chips, washed down from pyroclastics (Tbp), S. side of creek, 1 mile E. of Wattle Hill,

1000 ft. upstream from road bridge (F.L.S., obs.).

155. Wattle Hill *. Quarried jasper-agate blocks, W. of pyroclastics (Tbp), Wattle Hill-Nugent Road, just E. of Noble Farm (F.L.S., obs.).

156. N. Mt. Elizabeth *. Quarried jasper-agate-opal veins in silicified pyroclastics (Tbp), S. bank of Iron Creek tributary, S. W. of Noble Farm (F.L.S., obs.).

157. N. Mt. Elizabeth *. Quarried cherty opalised hornfels (Jdl-Tbp-Pms), hillside S. of Iron Creek tributary,S. of Noble Farm (F.L.S., obs.).

158. Forcett Creek *. Extensively quarried jaspery outcrop (Jdl-Tbp-Trs), shore bank, just N. of creek mouth, Pittwater (F.L.S., obs.).

159. Sorell *. Worked seams of jasper-opal in basalt, foreshore between Pittwater Causeway and Sorell Rivulet (F.L.S., obs.).

160. Pipe Clay Lagoon. Worked outcrop of cherty conglomerate-breccia (Tbs?), E. side of lagoon, South Arm (Roth, 1899; Noetling, 1909b; Green, 1961; Lourandos, 1968; R. M. Jacklyn, pers. comm.).

161. Goat Bluff. Small quartzitic quarry, S. of Collins Springs (W. D. Jackson, pers. comm.).

162. Droughty Point *. Large, loose quarried boulders of silicified breccia, on beach (Noetling, 1909b; R. M. Jacklyn, pers. comm.).

163. Tranmere Point. Quarried silicified breccia, S. of point (W. D. Jackson, pers. comm.).

164. Lindisfarne. Rare, worked cherty hornfels blocks (Tbs-Pms), above shore between Lindisfarne and Geilston Bays; site now largely built over (F.L.S., obs.).

165. Geilston Bay *. Worked cherty hornfels blocks (Tbs), old lime quarry; site now occupied by golf course (F.L.S., obs.).

166. E. Shag Bay *. Small, worked opal-quartz seam, 120 ft. above S. bank of creek, E. end of bay (R. M. Jacklyn, pers. comm., F.L.S., obs.).

167. Shag Bay.*. Worked seam of opal-quartz rock, 30 ft. above E. end of S. bay shore; site largely destroyed by collectors (R. M. Jacklyn, pers. comm.; F.L.S., obs.).

168. Risdon. Worked mudstone outcrop (Pms), and blocks up to 1 ft. across, hillside, 100 ft. above Tommys Bight (R. M. Jacklyn, pers. comm.).

169. Cove Hill. Worked quartzitic fragments (Jdl-Tbs-Trs), E. bank of Jordon River above its mouth, 1 mile W. of Cove Hill (W. D. Jackson, pers. comm.; F.L.S., obs.).

170. Blinking Billy Point *. Worked jasper-opal seams in pyroclastics (Tbp), on foreshore; site now largely destroyed by collectors (W. D. Jackson, pers. comm., F.L.S., obs.).

171. Kingston *. Worked cores of "greybilly" (silicarenaceous cherty hornfels) in paddocks N. of Whitewater Creek, ½ mile W. of its junction with Browns River (M. R. Banks, pers. comm.; F.L.S., obs.).

172. North West Bay *. Quarried cherty hornfels, quartzite and silicified breccia (Tbs-Trs), W. of mouth of Coffee Creek, below Howden Road, 1 mile E. of Channel Highway (M. R. Banks, pers. comm.; F.L.S., obs.).

173. Margate *. Quarried boulders of "greybilly", 500 yds. S. of old Sandfly Wharf (Lewis, 1946, 149; Lourandos, 1968). Similar cherty hornfels and quartzite has been worked to the N. around Dru Point while sandstones (Trs) altered to quartzite were sporadically worked along the shore towards Electrona. These rocks probably mark the basalt lead from Margate.

174. Oyster Cove *. Extensively quarried cherty hornfels and quartzitic breccia (Pms) outcrops on S. shore (Crowther, 1950; Lourandos, 1968; F.L.S., obs.; Plate 5). Similar rock occurs above the S. E. junction of Oyster Cove Road and Channel Highway, and on the S. shore, Little Peppermint Bay.

175. Barnes Bay *. *Ibid*, Chalky Point, N. side of bay, Bruny Island (N. & P. Young, pers. comm.; F.L.S., obs.).

176. Great Bay *. Quarried boulders and outcrops of cherty hornfels (Jdl-Pms), towards S. end of bay, Bruny Island (Lourandos, 1968; F.L.S., obs.).

177. N. Daniels Bay. Worked cherty hornfels, quartzite and quartz pebbles and boulders, shore 1½ miles N. of Daniels Bay, Bruny Island, F.L.S., obs.).

178. Woodbridge *. Rare, worked cherty hornfels and silicified breccia pebbles, on shore around creek mouth, S. end of Woodbridge (F.L.S., obs.).

179. Gordon. Worked poor-grained, white-grey quartzite pebbles, on channel shore (B. H. Brimfield, pers. comm.).

180. Huon Point. Reported quarry, probably cherty hornfels (Jdl-Trs), N. of point (Lourandos, 1968 and pers. comm.).

ADDITIONAL DATA

The Tasmanian Museum collection contains some remarkably large flaked stone Aboriginal "axes", not yet described in the literature. They were collected from the Bothwell area between 1949 and 1963 by Messrs. Maning and Rodway (site 133 in this appendix). They reach about 18 inches across, range from 4 to 40 lbs. in weight and must be amongst the largest flaked implements from Australia; their exact function in uncertain. This site was relocated by the author in early 1971 and further specimens collected (Tasm. Mus. M4098). The material varies from silicified breccia into silicarenaceous cherty hornfels and occurs scattered on the river flats 200-300 yds. N. of "Woodspring" Road, 13/4 miles E. of "Dennistoun" Road junction, 4½ miles directly E.N.E. of Bothwell township. The site is poorly exposed and has been greatly disturbed by pastoral clearing.

Hunter Island, N.W. Tasmania, was visited by Tasmanian Aborigines by canoes from the mainland. During a visit to the Island in February, 1971, the author collected flaked stone implements from midden sites on the west coast and in the large stranded sea-cave on the east coast. The implements were made predominantly from quartzite and some quartz (less than 5% of collections) from the local Pre-cambrian rocks. Waterworn surfaces on many of the implements indicate that much of the stone came from pebbles and boulders along the shore, and no worked rock types were found suggestive of implements carried over by the Aborigines from the mainland.